GAS

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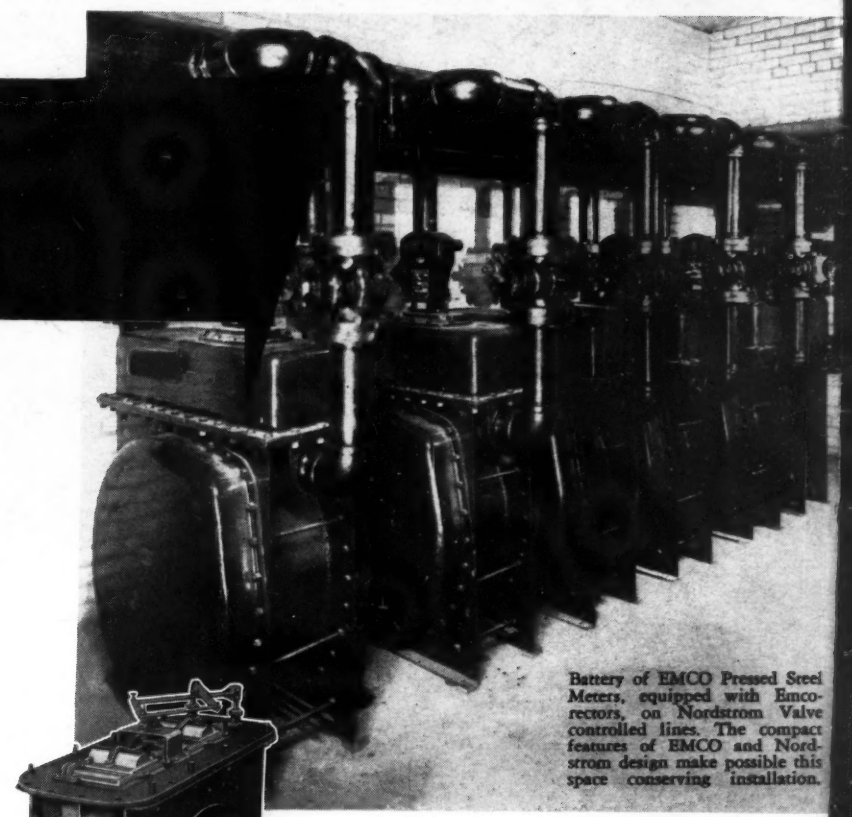

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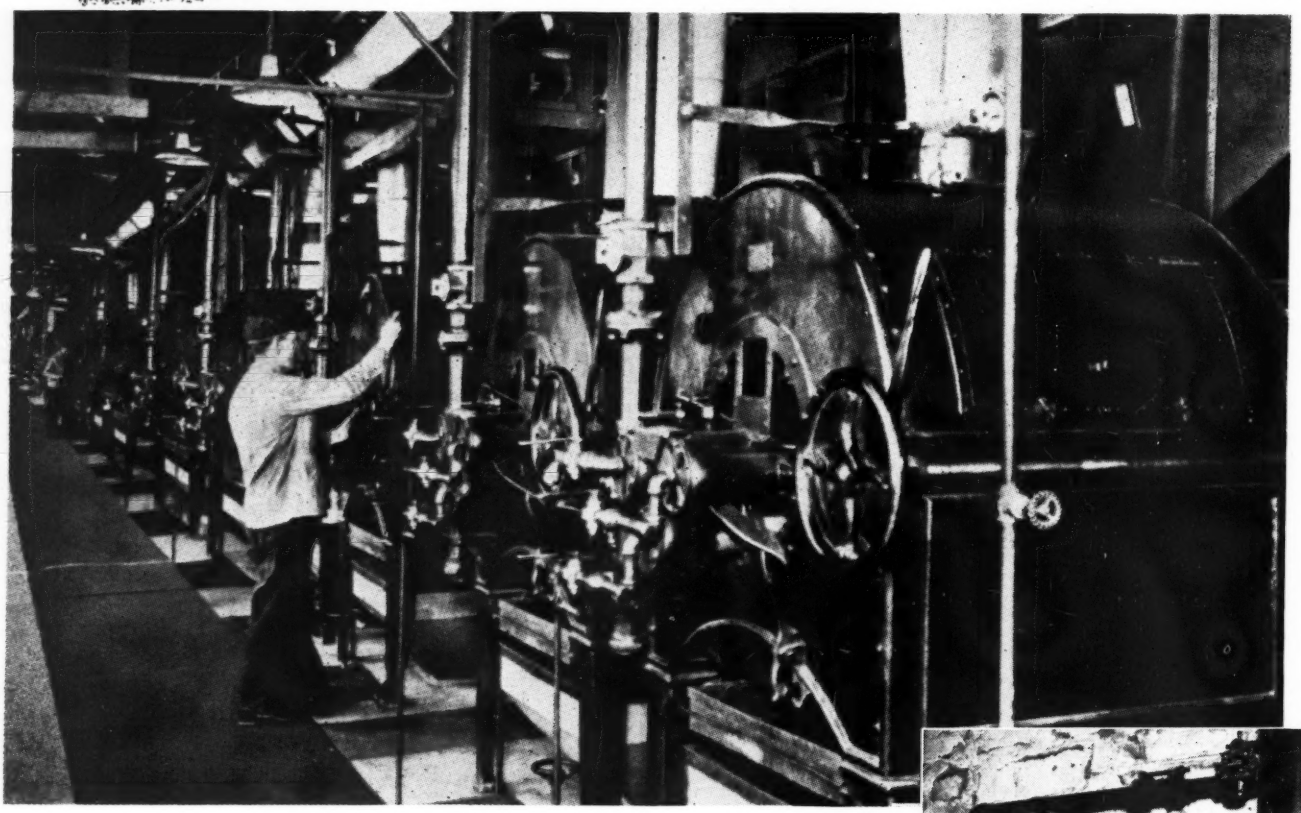

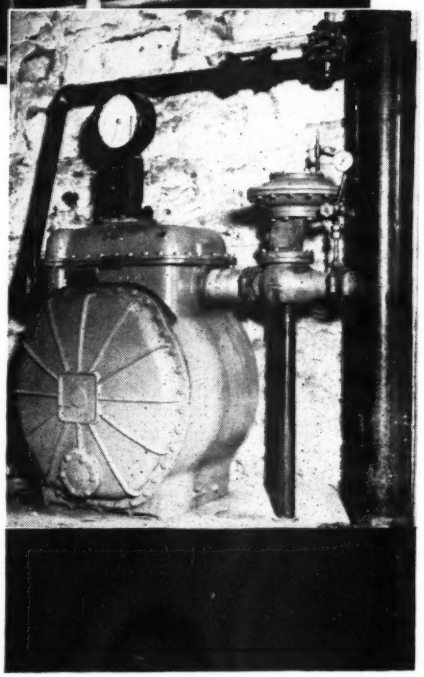

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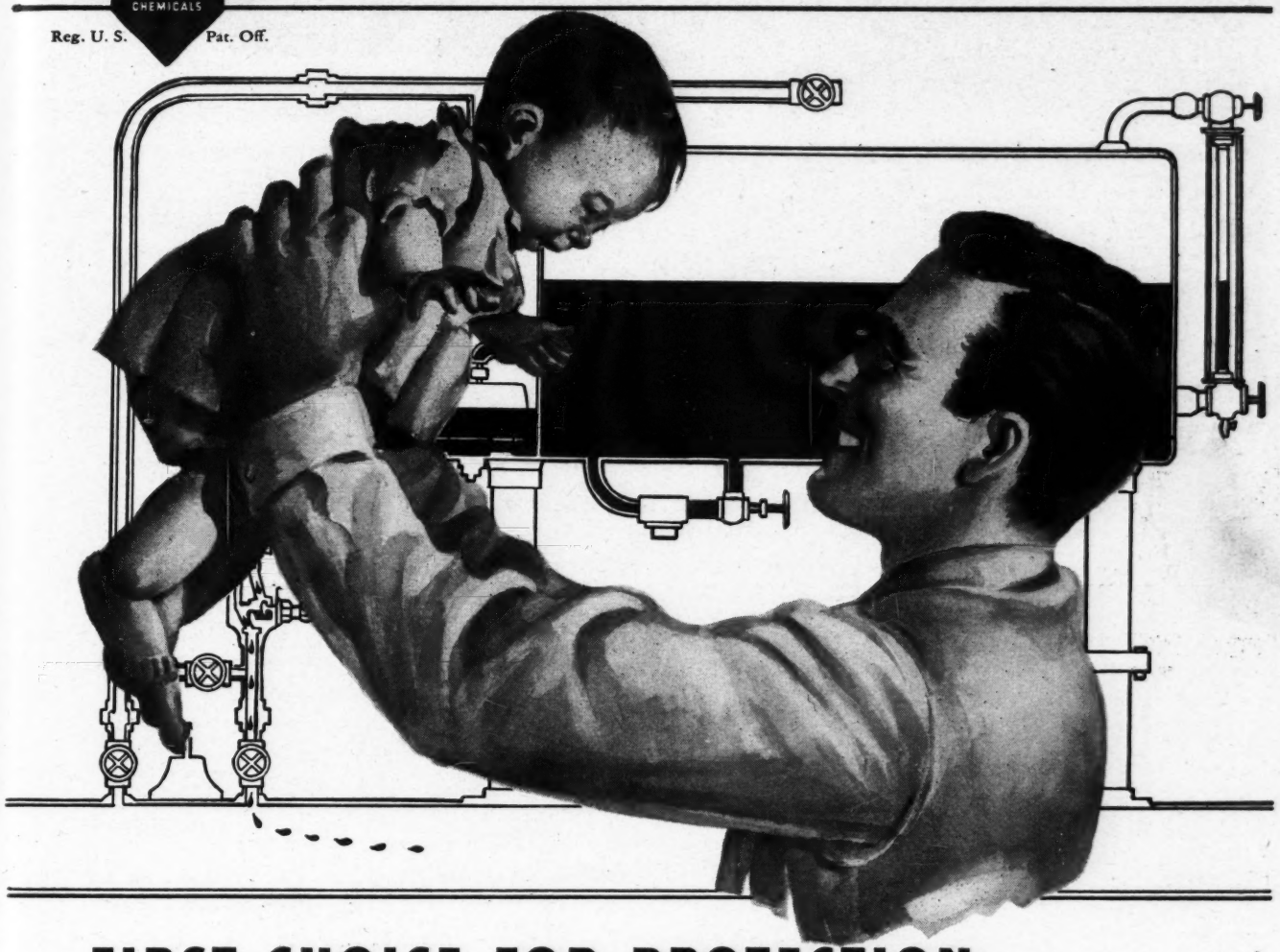

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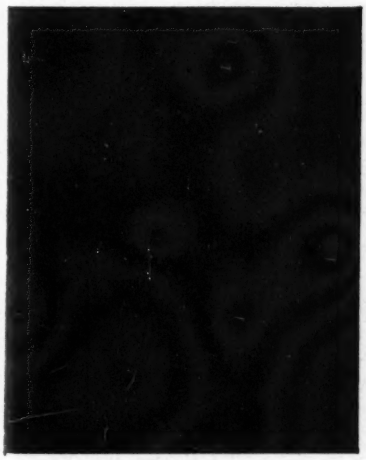

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70% Recovered	259
90% Recovered	320
End Point	375
Recovered	98%
In Flask	1
Loss	1
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Hydrogen Sulfide	None
Acid or Caustic	None

*REG. U. S. PAT. OFF. 1181

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GAS

REG. U. S. PATENT OFFICE

Twenty-Second Year of Publication

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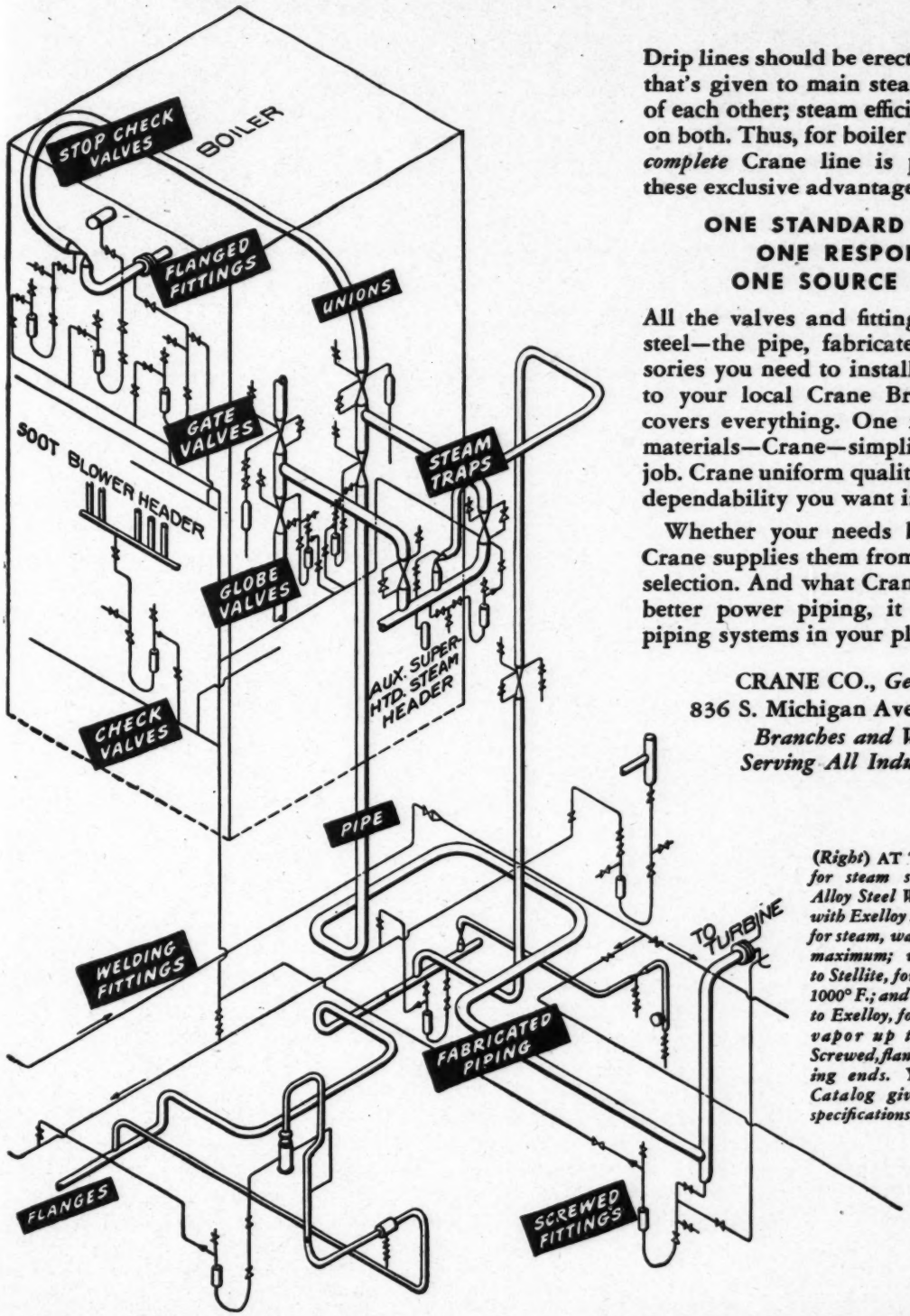

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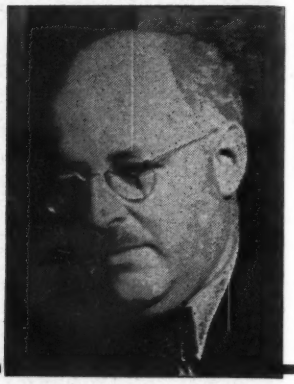
THERMALLY THINKING

By ELLIOTT TAYLOR, Editorial Director



Explosive Inflation

WHILE we are in agreement with the contention that an orderly relaxation of price controls, looking to their early termination should be the aim of government, we cannot go along with the new school of fiery commentators who demand the immediate freeing of our economy through the abrupt termination of all wartime ceilings.

It is true, the problems of inflation will be solved only by permitting at least some inflation, and getting it over with. The great excess of purchasing power built up by the lack of consumer goods to match high income levels will have to be whittled down appreciably before the national economy can once more take on an aspect of stability.

Prices may well rise to peaks higher than we have ever seen them, before they come to rest at a level that we will be safe in regarding as normal. When too much money sets out to buy too few goods, prices must inevitably give way. That is merely because people have enough sense to want the things that money can buy more than they want the money itself.

But the type and character of inflation that may be expected, and of which our present situation is only a mild sample, is and should be a matter of concern not only to the gas utilities, but to all of the commissions, federal and state, that exercise regulatory powers over the industry.

It may be well enough for manufacturers to urge, as some of them are now doing, that the easiest way out would be to let price controls go by the boards; let the people buy whatever they can get at whatever prices they will have to pay, and rely on the resulting stimulation of uninhibited production to flood the market with an early supply of goods that would put an end to the seller's market as it exists today.

The gas companies as regulated utilities cannot afford to view this specious nonsense with complacency. With their rates fixed by regulatory order, they would be faced with rapidly rising costs on one hand—possibly coupled with demands for increasing service—but with rates that would make the meeting of those costs, or the rapid improvement of service facilities practically impossible.

Already the FPC and some state commissions show evidence of a shortsighted and unrealistic tendency to set about ordering rate reductions before the economic frame in which those rates will prevail can be defined. Predicated on the fact (which is true) that many utilities showed comparatively high earnings during the war, and that the elimination of the excess profits tax will leave funds in the amount of that tax available for other disposition, this reasoning proceeds on the assumption (which is false) that future earnings can be anticipated in some approximation of those of the immediate past.

Over the period of many years, rate reductions have become so exclusively the preoccupation of state commissions and the FPC, that any petitions for increases would be subjected to a most hostile and time consuming scrutiny. Thus a violent up and then down solution of the inflation dilemma would mean to the gas industry only that it would have to take its losses, and perhaps see an attendant deterioration in service, before the equity of any claims for rate relief ever came to the point of actual consideration.

On the other hand, a more orderly and controlled movement of prices upward under a policy of gradual relaxation prudently administered, could result in the termination of the inflationary trend at or near the general level that could be maintained over a comparatively long period. This would be decidedly to the advantage of the gas industry. In the first place, the attendant burden of costs would be made somewhat easier to bear by a continuation of a strong demand for gas and gas appliances, but without the need for expensive new facilities to handle the load. Then when prices had reached the level of economic value, rather than OPA ceilings, these new levels might reasonably be introduced into the studies on which future rates could be posited.

The difficulties that will be encountered, and the very real problems that will have to be met indicate also that this might be a good time for the industry as well as for regulatory bodies, to take into consideration the development of some new conception of rate making. There is need for a plan whereby rate structures may be rendered less susceptible to the whims and caprices of a shifting economy. The rate adjustment plan of the New Jersey Power and Light Co., now two years in operation, might yield a formula that could be adopted by gas utilities and by the regulatory bodies of other states. The principle of allowing the establishment of a stabilizing reserve to be paid into when earnings are excessive and drawn from when there is a deficiency seems simple and practical. It might well prove to be a scheme that would merit the support in principle of both government and the gas utility business.

But whether or not the rate adjustment plan, or any other sliding scale or self leveling plan is eventually adopted, this much is true as far as the present inflation is concerned: Nothing could be more damaging to the cause of gas utility service, and to the public who depend on that service, than the violent inflation that would follow the abrupt and complete termination of all price controls—all at once.

Plea for Presidents

THE Supreme Court decision in the North American case, upholding the death sentence clause of the Holding Company Act of 1935 merely sets the legal stamp on what had already been accepted as inevitable by most of the gas and electric ultilities.

The question of the justice, the wisdom, and the necessity for such drastic measures has long since passed into the realm of classic controversy from which no definite and final answers can ever be expected to emerge. The constitutionality of the basic principle involved is now settled by the recent decision.

With those who temper their opinions by the sagacious observation that much might be said on both sides of this question, we are in some accord, being chronic travellers of the middle of the road. But with those who still see it as an unwarranted and unnecessary invasion of the rights of private business, we are in flat disagreement. The evils possible under a system of monopolistic absentee control of the utilities are too apparent to need detailed enumeration on our part. The evils that have already been disclosed are a matter of poignant record.

Essentially, the delivery of gas service to the homes, to the commercial, and industrial establishments of any community is a local enterprise, and it is better by far that it be always identified as such. We have observed that even where gas companies were part of some one or another of the so-called utility empires of passing memory, they were always at great pains to create and foster the illusion that they were really home products. "Owned, managed and operated by Californians, or by Georgians or by Texans" was a type of slogan always regarded as sure fire in any sensible public relations program.

We believe that even when it was no longer technically accurate to make the claim, there was still great gain to be derived from a gas company thus seeking to maintain its close identity with local interests, local citizens and local service. The thing that has made the gas industry grow great, and that has given it a place in public esteem that even political maneuvering has been unable to destroy, has not been the stability of investment offered by large blocks or by assorted permutations and combinations of stock holdings in the portfolios of far-off financial houses. The rock upon which industry reputation was founded has always remained the same, the unfailing, the unwavering, the at times even selfless devotion to public service that was an article of industry faith, long before it was ever enunciated as a creed. That faith and devotion to service was in the custody of men, of local men, who were known and respected and regarded as leaders, each in his own local sphere.

The return of ownership and management to local companies, as free and integrated units in their own respective areas has sometimes been spoken of lightly as a passing of control from strong hands to weak. That is a gross and fundamental error. The passing of control back to local initiative and local sagacity is returning it rather to the strength from which it was originally derived. It is the strength inherent in running a gas company, just one, and running it right with never a mind for the fate of the utility empire. It is the strength of men who knew that the holders must never be let down, whether the Dow Jones averages were on a rise or on a decline.

Men who were once just called presidents of companies, now find themselves presidents in fact. Men capable of initiative and decision now find that these sterling qualities are again in demand, and the need for them more pressing. Their responsibilities are great, but the gain to the gas industry will be immeasurably greater. Alert and understanding response to local problems is already being manifested in instance after instance that could be cited. Gas service has come back home.

We believe that the re-identification of that service in the public esteem as a private industry by right, has already begun as a result of this very trend toward local atonomy. It will flourish and grow in just the measure that local management is really local, to the extent that responsibility and authority over local affairs rests with those who in the eyes of their neighbors, and we might add in the eyes of the voters, have once more become in truth, as well as by name and title, the very embodiment of public service.

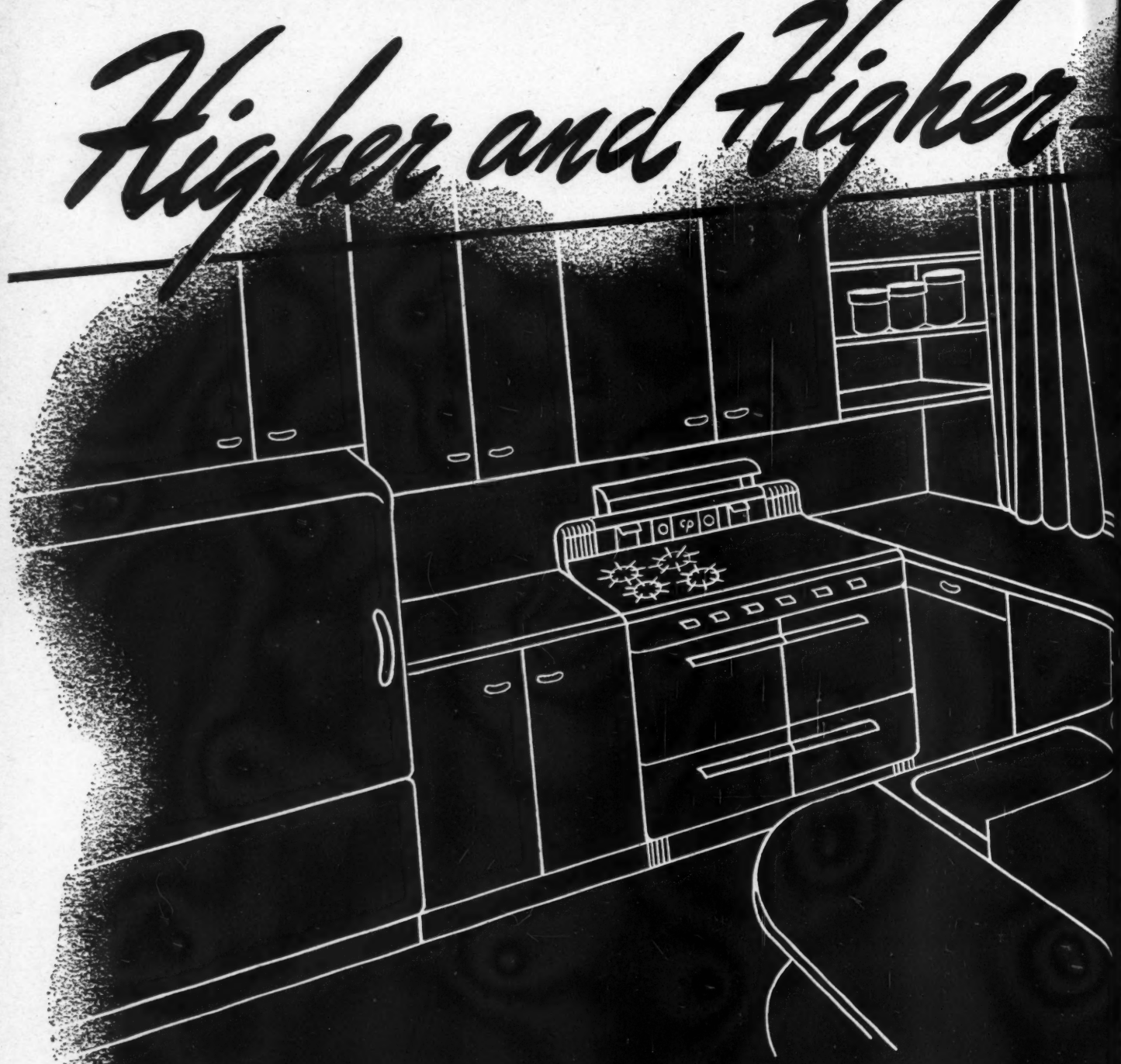
West Virginia Objects

HAD the Federal Power Commission need of any further evidence that in its Docket G-580 investigation it had backed up into a political buzz saw, that evidence was amply and eloquently supplied by Governor Meadows of West Virginia when he appeared in the last of the field hearings, just concluded at Charleston. Said His Excellency:

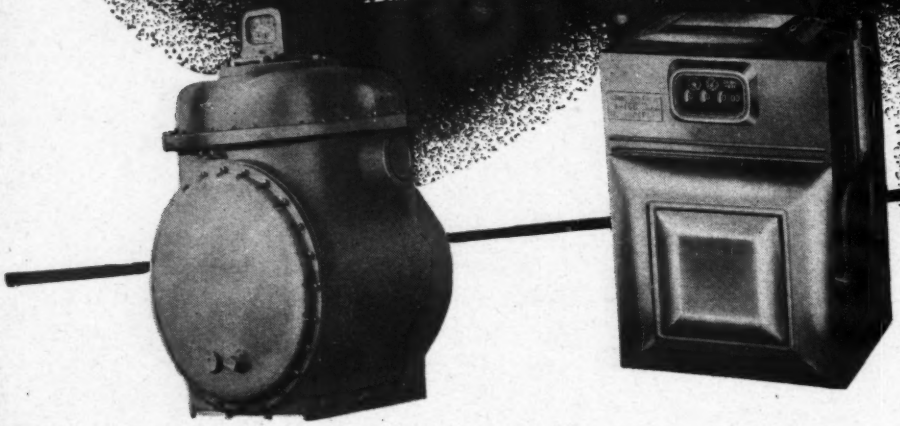
> "It has never been seriously considered that the American conception of 'dual sovereignty' . . . contemplates displacement by the federal government of the powers of the state to regulate the production, transporation, distribution or sale of commodities produced, distributed, sold and consumed within the state. To the extent that such displacement may be attempted, whether by law, by regulation, by subtle encroachment or beguilement, every such attempt will be met by every available, lawful means within the power of the state to employ. . . .
>
> "It would be consistent with her duty to oppose and strike down as unlawful and usurpatory any regulatory measure, not imposed by her own authority, that may restrict, or tend to restrict, production in our state below the demand of the market. . . .
>
> "So far as West Virginia, her people and her economy are concerned, we refuse to recognize any ideology which, no matter by what means or in what guise it may be presented, is purposed or may tend to involve our natural gas industry in . . . nationalization. . ."

We keep wondering, if anything should happen to Tom McGrath of the coal crowd, or Col. Frye of Louisiana, just who in hell the FPC would get to support it when it appears before Congress to ask for the new powers that have been soundly denounced at every single state hearing.

Higher and Higher



AMERICAN METERS



RELIANCE REGULATORS

Highlights

• Gas appliance manufacturers must expect to have something to show in Atlantic City by the time the gas convention meets there in October. GAMA reports that three days after the prospectus and floor plan of the great auditorium had been sent out to its members, booth space totalling 24,000 sq. ft. had been booked for exhibits. This represents space equal to 44% of the 55,000 sq. ft. sold at the last gas appliance display in that city, held in 1936.

• A gas utility sales department that breaks even on merchandising but increases the gas send out is more of an asset to the company than one that shows a profit on appliances sold, but little increase in gas sales. So Al Howard, assistant sales promotion manager of Servel told the Mid-West Gas Association at its April meeting in St. Paul.

• Present predictions are that the Washington hearings in the Natural Gas Investigation will last six weeks, starting June 17. The FPC has invited interested parties to file summary statements of their views within 60 days after the hearings close. That means that the new Congress to be elected this fall, and not the present one, will consider any suggested amendments to the Natural Gas Act. The make-up of that body may have much to do with the future of natural gas regulation.

• Volume 1 Number 1 of an A.G.A. industrial and commercial gas section News Letter put in its appearance late in March. The letter reports that the section has over 850 members, representing every state in the Union and some foreign countries as well.

• On April 1, 1946, the Federal Power Commission had in its pending docket file 24 applications that pertained to projects involving 8997 pipe line miles, with several compressor stations. The total estimated cost of the projects under consideration is $350,432,-815, according to a statement by E. Holley Poe, natural gas consultant of New York and Washington.

• During the war period, 1942-1945 there were 2051 strikes in the coal industry involving 1,624,755 workers in 17,390,535 idle man-days. Strikes during the same four years in the natural gas and crude petroleum industry totalled 10 with 5884 workers out for a total of 43,720 man-days. Hilding Carlson, former regional economist for the United States Bureau of Labor Statistics presents these and other illuminating data in his discussion of Strikes and Labor Relations in the Fuel Industries. (See page 31.)

• Butane and propane production from natural gasoline and cycle plants showed a slight increase in January, 1946 over the same month for last year, according to Bureau of Mines figures just released. Significant was the fact that of this total production, a higher percentage was shipped for use as fuel. The figures: Total production, January, 1945, 92,477,000 gal.; January, 1946, 94,788,000 gal. Sold for fuel, January, 1945, 60,116,000 gal.; January, 1946, 75,920,000 gal.

• The University of Tulsa has announced two new short courses, one in gas appliances, for four days, June 11 to 14, and the other covering liquefied petroleum gas appliances, June 18 to 21. Both courses deal with the theory and practice of utilization of the fuels, with particular emphasis on safe handling of liquefied gas. Instructors will be from the industry. The fee is $10 for each course.

• In appraising the so-called back-log of demand for appliances and equipment, consideration should be given to the possibility of an unusually large duplication of orders. There may be a buyers' market as early as next fall, in the opinion of James W. Carpenter, vice president of the Long Island Lighting Co., speaking before the New York-New Jersey regional gas sales conference.

• How hot is hot water? Frank McFerran, sales manager of Ruud Manufacturing Co., Pittsburgh, offers his definitions: Lukewarm, 90 to 105°; warm, 105 to 120°; hot, 120 to 150°; very hot, 150 to 180°.

• Panhandle Eastern Pipe Line Co. has applied to FPC for approval of a $27.3 million construction program to be completed within the next two years.

• The Supreme Court has ruled that the State of Texas may not collect taxes from Southwestern Gas and Electric Co. under the chain store tax law for 1941, 1942, and 1943.

• Big Inch, Inc., a new corporation headed by Charles H. Smith of New York, has offered $40 million for the Big Inch line. The corporation plans to spend $30 million to convert the line to natural gas.

• Applications for consideration for the Charles A. Munroe Award should be submitted to A.G.A. headquarters by August 1, according to Clifford E. Paige, award committee chairman.

Another Step Forward

in the Modernization of
SPRAGUE GAS METERS
Now appearing
in its Streamline Case

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THE NATURAL GAS INVESTIGATION

By WESLEY E. DISNEY

Counsel for the Natural Gas Industry Committee

THE Natural Gas Investigation by the Federal Power Commission, under Docket G-580, is the arena for a clash of competing interests. Natural gas is a highly desirable fuel, indispensible in some instances and sought for by domestic and industrial users. It is a keen competitor of coal. For many years the coal, labor union and railroad interests have intervened in natural gas pipe line certificate cases, in efforts to prevent the building of pipe lines into industrial areas.

The whole matter was brought to a head when, on the 11th day of January, 1945, Senator John Overton of Louisiana, introduced in the United States Senate, Senate Joint Resolution 13, authorizing and directing an investigation by the Federal Power Commission of the natural gas industry. This resolution made reference to "economic waste and undesirable competition with and displacement of other fuels" and "the utilization of natural gas for inferior or otherwise undesirable purposes in competition with other fuels".

After suggestions and considerations, it was decided that since the Federal Power Commission, under the Natural Gas Act, has the right, on its own initiative, to make investigations looking to legislation, and had inaugurated the investigation, the Overton Resolution was abandoned and $80,000 was appropriated for the expense of the Commission in the investigation.

Object of the Investigation

The object of the investigation, as stated in the notice and outline issued by the Federal Power Commission, is to make a complete review and history of the operation of the Natural Gas Act, its effect on the industry and the details of its operation on the economy of the nation. It is understood that after investigation, the Commission will prepare conclusions of fact and recommendations to the Congress for such suggested legislation as it considers necessary and that the interested parties will have the opportunity to make suggestions and criticisms before the draft is final. Briefly stated, the general issue is whether the testimony justifies recommendations to the Congress by the Federal Power Commission for legislation and if so, what legislative action should be recommended.

The Agenda of the Federal Power Commission

On June 27, 1945, the Federal Power Commission formally advised the public that the Natural Gas Investigation, Docket G-580, would be conducted. The avowed intent of the notice was to furnish all interested persons an opportunity to present their views, to secure as much information as possible on all matters relative to the investigation as expeditiously as possible. Opening at Kansas City, successive hearings were held at Oklahoma City, New Orleans, Houston, Biloxi, Chicago and Charleston, West Virginia. A final hearing is scheduled at Washington, beginning June 17, 1946. The Commission presented an Outline of Principal Topics for the hearings, which comprised (1) reserves of natural gas: (2) practices and problems as related to production for interstate commerce: (3) the extent and control of physical waste; (4) state laws governing production, waste and conservation; (5) interstate pipe lines; (6) utilization of natural gas; (7) the potentialities of synthetic production.

Wesley E. Disney

AS COUNSEL for the Natural Gas Industry Committee, Wesley E. Disney has been in close personal contact with every piece of testimony that has been presented since the start of the hearings in September 1945, on the Federal Power Commission's Docket G-580 investigation of the natural gas industry. Here he sums up the trends in the testimony that can be taken to indicate the final course that will be taken by the Commission, by the opponents of natural gas expansion, and by the gas industry. He voices the opinion increasingly prevalent that the investigations are seen by all parties as preliminary to a fight before the Congress over the question of end-use and the advisability of bringing it under federal regulation.

Having served seven terms in Congress, as a representative from the State of Oklahoma, he is in a particularly favorable position to advise the industry regarding the type and scope of presentation that will be of the greatest value to the legislators when the knotty natural gas problem comes before them. Mr. Disney is a leading trial lawyer of Tulsa, Oklahoma, member of the firm of Disney, Houston and Kline, with branch offices in Washington, D.C. He has been a county prosecutor, member of the Oklahoma house of representatives, and member of Congress from 1930 to 1944. From 1935 until his retirement he was a member of the Ways and Means committee, where he was regarded as an authority on public expense and taxation. He is a native of Kansas, and a graduate (1906) of Kansas University.

Appearances Made at the Hearings

Commissioner Nelson A. Smith has acted as Supervising Commissioner for the hearings, which have also been attended by other members of the Commission. At the hearings, there appeared representatives of states, cities and municipalities, producing and pipe line companies, and consumers, as well as companies, producers and pipe line transporters. The Independent Natural Gas Association of America appeared, as well as the Natural Gas Industry Committee. The Federal Power Commission was represented by its staff and counsel selected for the purpose of the investigation.

The public interest in the investigation is illustrated by the following appearances at the Kansas City session, typical of the other regional hearings:

Navy Department
Kansas State Corporation Commission
Missouri Public Service Commission
Public Service Commission of Wisconsin
Arkansas Public Service Commission
Interstate Oil Compact Commission
Arkansas Oils and Gas Commission
Oklahoma Corporation Commission
Independent Petroleum Association of America
Railroad Commission of Texas
State of Texas
State of Mississippi
State of Louisiana
City of Kansas City, Missouri
City of Milwaukee, Wisconsin
City of St. Louis, Missouri
City of St. Paul, Minnesota
City of Wichita, Kansas
Bureau of Mines, Petroleum Division, Department of Interior
Iowa Power and Light Company
Kansas-Nebraska Natural Gas Company
Northern Natural Gas Company
Cities Service Gas Company
Consolidated Gas Utilities Company
Koppers Company, Inc.
National Coal Association
Illinois Coal Interests
Illinois Coal Traffic Bureau
Central Illinois Coal Traffic Bureau
Belleville Fuels, Inc.
Districts Coal Traffic Bureau
Middle States Fuels, Inc.

Northern Illinois Coal Trade Association
Lake Michigan Docks Association
Solid Fuel Institute of Milwaukee Co.
Maher Coal Bureau
Association of American Railroads
Railway Labor Executives Association
Order of Railway Conductors
Brotherhood of Locomotive Engineers, Firemen and Enginemen
Switchman's Union of North America
American Retail Coal Association
United Mine Workers of America
Wisconsin State Federation of Labor
International Brotherhood of Electrical Workers Union 494
Operating Engineers Union 311
Operating Engineers Union 309
Painters Consolidated Local 781
Boilermakers and Helpers Union Local 107
International Chemical Workers Union Local 152
Firemen and Oilers Union Local 125
Machinist Union Lodge
Coal Dock Workers Union Local 1343.

The representatives of the coal, railroad and labor interests took an active part in the cross-examination of all witnesses in an effort to elicit from the witnesses all points in favor of their competitive arguments for end use control. The list is typical of appearances in rate and certificate cases.

Issues Involved in the Investigation

Chiefly, the outstanding issues so far appearing as most important to the interested parties, as well as the Commission's staff, are (a) end use control; (b) production and gathering of natural gas as effected by the Natural Gas Act; (c) direct sales of gas by interstate pipe line companies; (d) utility status of one connecting with and selling gas to an interstate pipe line; (e) conservation; (f) field price.

"End use control" is the issue about which has revolved the controversies between natural gas and its competitors. The coal industry fears gas as a competitor; the railroad interests foresee the loss of business in the freight transportation of coal; the labor unions view gas as a competitor with coal which would displace coal miners, railroad employees, dock workers and marine workers. All of these interests cooperate in their antagonism to natural gas as a fuel. They have long sought to convince the Commission that under existing law, the Federal Power Commission has authority to adopt the theory of end use control with reference to interstate pipe lines. The Commission to date, with an exceptional case or two, has refused to make this decision, but it has indicated that the Congress should give it such authority.

Under present law, the Commission, in granting certificates of public convenience and necessity for the building and operation of interstate natural gas pipe lines, has considered (except in one or two isolated instances) certain factors or minimum standards, namely: (1) an adequate supply of natural gas owned or controlled by the applicant for a certificate to meet the demand; (2) adequate facilities to render service in the territory to be served; (3) adequate financial resources for the construction of such facilities; (4) reasonable cost of construction; (5) existence of a consumer demand in the area to be served.

Standards Adopted

Although the adverse interests alluded to have long demanded that the Commission consider "social and economic effects" of the use of gas in a competitive area, the Commission has adopted the above-named "standards".

Throughout the investigation, the interests competitive to natural gas have consistently pursued the same theory—that the social and economic aspects of the area to be served shall be mandatorily considered by the Commission, and they insist and will demand that the Commission recommend to Congress, legislation that will require or permit the Commission to refuse to issue a certificate of convenience and necessity to pipe lines which propose to serve an area with natural gas where there is an available supply of coal. In other words, these competitive interests would give the Commission legal authority to control the end use of natural gas as a fuel, both domestic and industrial.

The natural gas industry contends that the Commission has no such present authority, should not be given such authority and if such legislation were enacted, it would be in violation of the Constitution of the United States under the doctrine that under American free enterprise, any owner of personal property reduced to possession has the right to sell in any market in which he may compete, and any consumer has the right to buy such personal property in the competitive markets. Certain official and nonofficial interests in the State of Louisiana, a gas producing state, share the views of the railroad, coal and labor interests, but on a different theory, that by such a trade barrier, natural gas would be retained in Louisiana and the location and development of industry therein would thus be encouraged. But paradoxically, there is no contention that boiler gas used in Louisiana would be an "inferior use". Boiler gas in Detroit is inferior (to them) but in Louisiana it is Boiler Gas!

The Natural Gas Act specifically confers on the Federal Power Commission jurisdiction of the interstate transportation of natural gas for resale for ultimate public consumption, but a special proviso deprives the Commission of jurisdiction over the production and gathering of natural gas. However, in the Canadian case (*Canadian River Gas Co. vs. Federal Power Commission*, 324 U. S. 581), the Commission, by fixing rates of produced gas on a cost basis, assumed jurisdiction of production and gathering in spite of the statute and the Supreme Court sustained the Commission's action in a divided opinion.

This opened a veritable Pandora's Box of possibilities, with attendant fears and misgivings on the part of the industry. It is suggested that if the Commission has jurisdiction over production and gathering of gas, that petroleum and gas being so intimately related and produced from the same wells and stratas, the next conceivable step would be jurisdiction by the Commission over *oil* produced. In other words, jurisdiction over production and gathering is jurisdiction to the bottom of the hole for all purposes and all productions, natural gas, crude petroleum, casinghead gas and condensate. Numerous other difficulties are involved which compel the natural gas industry to take the position that the law should be amended on this subject and that Congress enforce its original mandate.

FPC and "Direct Sales"

The Natural Gas Act gives the Commission no jurisdiction over socalled "direct sales". In its most recent utterance, the Commission, in the *Panhandle Eastern Pipe Line Company* case (decided on March 14, 1946) used the following language:

> "The Commission wishes to make it plain that its action in this matter is not to be construed as an attempt to assert jurisdiction over a direct sale of gas as such."

Direct sales are ordinarily construed as meaning sales to a specific customer rather than to the consuming public at large. These are competitive, arms-length transactions and when made by interstate transporters of gas are not regulated by Federal authority. The Congress, in passing the Natural Gas Act, took the position that competition would be the best arbiter of rates in direct sales. In recent months, however, the Indiana Public Service Commission, and later the Michigan Public Service Commission, have issued or-

ders asserting jurisdiction over direct sales by an interstate pipe line. These orders are, or probably will be on appeal to the courts. Conceivably the Commission's report and recommendation to Congress will contain a proposal that jurisdiction of direct sales be lodged in the Federal Power Commission. Hence, this bids fair to be an important issue to the industry so far as both the states and the federal government are concerned.

Status of Producers

Question: Does the producer of gas from gas or oil wells or a utility who is in fact not a transporter of gas in interstate commerce, who connects his gathering lines to an interstate pipe line and makes a sale of gas, thereby become a natural gas company as defined in the Act, because his gas enters the flow of interstate commerce? If he does, he becomes subject to the jurisdiction of the Federal Power Commission, subject to its accounting system and subject to its minimum allowance for earnings—lately 6%. Parties have violently protested that they do not thereby become natural gas companies. The Commission, in its original holding in the Columbian case (Opinion No. 48, June 29, 1940) held to the producer's and independent utilities' contention but a decision by the District of Columbia Court of Appeals, in what is known as the Peoples case (*Peoples Natural Gas Co. vs. Federal Power Commission*, 127 Fed. (2d) 153), is held by some to have upset the Columbian case. The natural gas industry is entitled to have this situation clarified. Its ill effects were clearly demonstrated by the testimony of witnesses at the Houston hearing which will be later touched on.

Conservation of natural gas is one of the topics of the Federal Power Commission's original outline. Much testimony has been adduced at the hearings on that subject. *There is no waste of dry gas.* Casinghead gas flared from oil wells, especially during the pressure period of the war, has not been wholly conserved for many reasons. It was vitally important to produce every possible barrel of oil for the nation's defense in war. Oil wells were pushed beyond their proper capacity, to reach the immense maximum required for defense. Gas produced with oil *had* to be used to bring the oil to the surface. There was no place to put this gas so it had to be flared if the maximum of oil was to be produced. Interstate pipe line capacity was not sufficient to move it to the markets. Lack of manpower and construction material, due to the war, contributed to this effect.

Since the cessation of hostilities and the pressure for a maximum amount of oil has eased, immense strides have been made in the conservation of flare gas. The hearings have demonstrated that the anxiety of the industry itself to conserve the gas, coupled with the splendid cooperation of the regulatory authorities of the various oil and gas producing states, that flare gas will soon be a thing of the past. Re-cycling plants for the injection of casinghead gas back into the ground, are the order of the day. The hearings furnished convincing proof that efforts by the industry and the state regulatory authorities to conserve gas is genuine and is result-producing. There is no need for federal regulation.

In that connection, a discussion of field price is pertinent. Conservation of a valuable product is automatic under economic forces. Waste of a cheap product is rather natural. The immense demand in non-gas producing areas, the building of additional pipe lines, the discovery of additional uses for natural gas, and other controlling elements, lead to the belief that the field price of gas will be greatly enhanced in the near future. In fact, a better price for gas in the field would meet some of the arguments of competitors of natural gas in the nonproducing areas. Throughout the testimony in the investigation where the subject of field prices has been touched on, the evidence supports a serious claim for higher field prices, a demand as strong as the desire of consumers for more gas. In the opinion of the writer, a more substantial field price would solve many of the problems, not only of conservation, but of conflicting business interests. It would not injure the consuming public.

Reserves of Gas in the United States

The proven estimated gas reserves in this country are tremendous. Notwithstanding the accelerated consumption of gas, the discovery of reserves has far outstripped the use of gas. Dr. E. DeGolyer, a noted and accepted authority of natural gas reserves, testified at the hearings that a conservative estimate of our proven reserves is 140 trillion cu. ft. Chiefly among the contributing causes of the enlargement of our reserves has been the discovery of new fields, and the deep testing of sands for oil. Whereas, a few years ago drilling to a depth of 4000 to 5000 ft. was considered a maximum, improved drilling methods send the bit down to 9000 to 11,000 ft.

It is estimated that our national supply of gas will last for a great many years. It can be accurately stated that our reserves are continuing to enlarge. The state regulatory authorities are in general accord with Dr. DeGolyer's estimates.

New discoveries are constantly occurring. The latest is the Skelly well in Texas and is of enormous proportions.

Regional Hearings

Each of these sessions took practically two weeks time and were conducted in the most thorough manner. Generally, it may be stated that these hearings consisted of testimony offered by state authorities and individuals or interested companies or consumers. The industry as such has reserved its case for the Washington hearing. The coal, labor and railroad interests have offered no case as yet. Interesting developments occurred at each hearing which will be touched on to give the whole picture.

The Kansas City hearing, at which Dr. DeGolyer testified as to the national reserves, was in the main directed by the Kansas Corporation Commission and the Missouri Public Service Commission. Governor Schoeppel of Kansas, discussed the history and activity of the Interstate Oil Compact Commission and the benefit to the oil-and-gas industry and the public. Chairman Richard McEntyre of the Kansas Commission was forthright in his declarations against "end use" control as was Milton Kinsey of the St. Louis Public Service Commission. In substance, Mr. McEntyre testified that Kansas desired industry to enter that state but that Kansas had gas to sell and desired to sell it in all markets. He was supported in this contention by other witnesses.

Lengthy testimony was furnished at this hearing on the subject of synthetic production from natural gas, establishing interesting and profitable development of synthetic uses. In this connection, it was admitted that all production of synthetics from natural gas could be duplicated by the use of coal gas. It was also established that only about 1% of the production of gas goes into the synthetic field.

The Missouri Public Service Commission, from a state in which practically no gas is produced, believed that the shipment of gas through Missouri should be accomplished with the right of Missouri to have sufficient gas for domestic and industrial uses.

The Oklahoma City hearing was directed by a committee appointed by

the Governor, chiefly revolving around the State Corporation Commission. Governor Robert S. Kerr made a powerful statement against state barriers and end use control as applied to natural gas produced in Oklahoma. The same position was taken by the Chairman of the Corporation Commission, Judge Reford S. Bond, who held that if there should be any end use control, it should be directed by the state authorities in the state producing the gas.

At the New Orleans hearing appeared a conflict of opinion. A school of thought in that state, headed by the former Governor Sam Jones, who admitted he was in the employ of the coal and railroad interests, supported by the present governor, Jimmie Davis, took the position that the exportation of gas from Louisiana should be extremely, if not wholly, limited, contending that if this procedure were adopted, the industry would be compelled to come into the state and make use of the state's natural resources at home. This theory was hotly rebutted by Congressman Charles McKenzie and by resolutions of many police juries (county commissioners) of many of the Louisiana counties. At this hearing appeared Major Allen of Memphis, Tenn., manager of the publicly owned gas utility for Memphis, who flatly disputed and contradicted the whole doctrine of end use control and substantiated his arguments despite the most thorough cross-examination. Governor Ben Laney of Arkansas filed a statement, and the State Commission by appearance, opposed the end use doctrine.

The Houston session was directed by a committee appointed by Governor Coke Stevenson, who himself appeared and in his statement held strictly to the doctrine of state's control over conservation. He opposed the end use control theory. All members of the Texas Railroad Commission appeared and gave lengthy statements and submitted to cross-examination. In substance, it may be stated that these official witnesses were in accord in their opposition to Federal control of production and gathering and to end use control for social and economic purposes. They had varying views as to the exportation of gas from the state. Governor Jack Dempsey of New Mexico in a filed statement supported the National Oil and Gas policy.

Testimony elicited from certain witnesses developed the fear of the industry concerning jurisdiction by the Power Commission over independent gatherers who connect with interstate pipe line transporters, and felt themselves in danger of being declared natural gas companies. They asserted that their bank credit was endangered if they assumed this status and all legal advice counselled against their sale of gas to an interstate transporter.

The Biloxi hearing was shorter. It developed there, as at Houston and New Orleans, that deep drilling for oil had encountered immense reserves of gas. In fact, during the sessions at Houston, New Orleans and Biloxi, the press reported the current finding in deep tests in the coastal areas, of vast quantities of natural gas from deep coastal area tests. The Governor, Attorney General, Conservation Commissioner of Mississippi, all took an antagonistic view to end use control and jurisdiction by the Commission of production and gathering.

In fact, every state regulatory authority, except for Louisiana, was positive that for the purposes of conservation and production and gathering, home rule was more desirable, as well as more effective.

The Chicago session, lasting two weeks, developed in the main, into a consumers demand for natural gas by the States of Minnesota, Wisconsin, Michigan, Indiana, Illinois, Iowa and Nebraska. Brushing aside all other considerations, the demand was for gas and still more gas with a reasonable regulation in the public interest and a willingness to pay as high a price (or more) as for coal. The vast majority of the witnesses did not believe that end use control of competitive fuels was either desirable or in the public interest. State Commissions of Indiana, Illinois and Wisconsin appeared or filed statements opposing end use.

The Charleston, W. Va., hearing (in session at this writing) commenced April 2, and was also, to a great extent, a consumers hearing. However, West Virginia, Ohio, Pennsylvania, Kentucky and New York are and have been producers of gas. A somewhat different situation is involved in the Appalachian area as to production and gathering, but in the main the witnesses have testified that competition between fuels is a matter to be determined according to the desires, the convenience and the necessities of the selling consuming public, rather than by Federal fiat.

Governor Meadows of West Virginia appeared, and in a brilliant statement opposed end use control. Governor Martin of Pennsylvania filed a statement.

Summary

A great preponderance of the testimony on the issues involved in these hearings contradicts the doctrine of end use control and establishes that the body of public opinion is to the effect that competition between fuels should not be determined by governmental decree; that the markets of the country should be free to all comers, both the buyers and the sellers, without governmental interference; that conservation, the prevention of physical waste, is a responsibility primarily on the responsibility. Production and gathering, in the opinion of the witnesses in general, being a state function, should not be subject to federal jurisdiction.

A majority opinion in the producing states, conceded by the consumers, as well as the competitive adversaries in the coal, railroad and union field, has developed that gas, for every reason involving the public interest, and particularly including conservation, should commend and receive a higher field price; that consumer costs would not be appreciably increased by a fair well-head price.

At the Washington hearing, the industry's case in chief, will be presented. It will cover all phases of the industry and the interest of the public, touching on the details set out in the Topical Outline given the public by the Federal Power Commission in 1945. The legal and administrative issues will be thoroughly developed. Atomic energy has been touched on in the regional hearings and probably will be developed, as far as possible, in the hearing at the Capital. The Washington hearing concludes the investigation. Then follows the report and conclusions of the Commission, coupled with its recommendations to Congress, probably made public late in 1946.

The investigation with Commissioner Nelson A. Smith presiding has been conducted with outstanding fairness and impartiality. Every witness was given a fair opportunity to present his views. The opening statements of Commissioner Smith at the regional hearings received unanimous approval.

Gas Sales Up in February

Sales of the gas utility industry in February totaled 2,626,255,000 therms this year, an increase of .7% over February 1945, the American Gas Association has reported. For the 12 months ending Feb. 28, 1946, utility gas sales totaled 24,905,806,000, a decline of 2.2% compared with the same period a year ago.

Natural gas sales gained .8% in February, but declined 2.6% for the 12 months ending Feb. 28.

STRIKES AND LABOR RELATIONS

In the Fuel Industries

By HILDING CARLSON

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LABOR relations predetermine, very largely, the extent to which a public-service industry can be depended upon to meet the responsibilities that are implicit in its very existence. The tempo and temperature of labor relations are gauged, with appreciable reliability, by the industry's history of work stoppages.

It is a simple fact that an industry with a history of relatively stable labor relations is more apt to maintain its production and service in the public interest than an industry that has more indications of labor unrest.

Natural Gas Industry

The labor relations of the natural gas production industry have been so nearly in balance that operations have been uninterrupted, by that industry-factor, for 20 years.

The natural gas and crude petroleum production industries, combined, have had an annual average of less than one and a half strikes since 1927. That is one of the lowest averages for work stoppages in all industrial groups for which there are official labor records.

The characteristics of the individuals in the labor force that produces natural gas, as well as management-attitudes account for the stability.

There were 28 strikes at the production level of the natural gas and petroleum industries during the past 19 years. Those strikes, 0.06% of the national total for all industries during the 1927-1945 period, occurred in 10 scattered years; there were no strikes in nine years. (Table 1.)

The workers involved in the strikes represent only a small part of the total labor force. The striking workers, during the 19-year period totaled 9079. The numbers in the individual years varied from seven workers in 1927 to 5600 workers, last year.

A study of labor relations in the production of natural gas and crude petroleum is hampered seriously by the unavailability of an authoritative current total for the number of workers employed and their average number of working days per year. The interest and need for more complete and current statistics pertaining to labor in the two industries warrants early attention by the Bureau of Labor Statistics.

Some impression of the extent of worker-participation in the production strikes of the natural gas and petroleum industries can be obtained by noting that 5600 workers were involved in the 1945 strikes. An approximation of 185,000 total workers is suggested by the author currently, after applying a recent employment index to the industries' worker-total in the 1940 census. The striking workers represent about 3% of the approximated 1945-total for all production workers. Each worker averaged 7.3 days of strike-period idleness.

There is sufficient evidence to believe that comparisons of the smaller numbers of striking workers in earlier years with the corresponding total numbers of workers; and comparisons of the fewer man-days idle during strikes with the total available working time, would reveal insignificant production-strike percentages for the natural gas and petroleum industries.

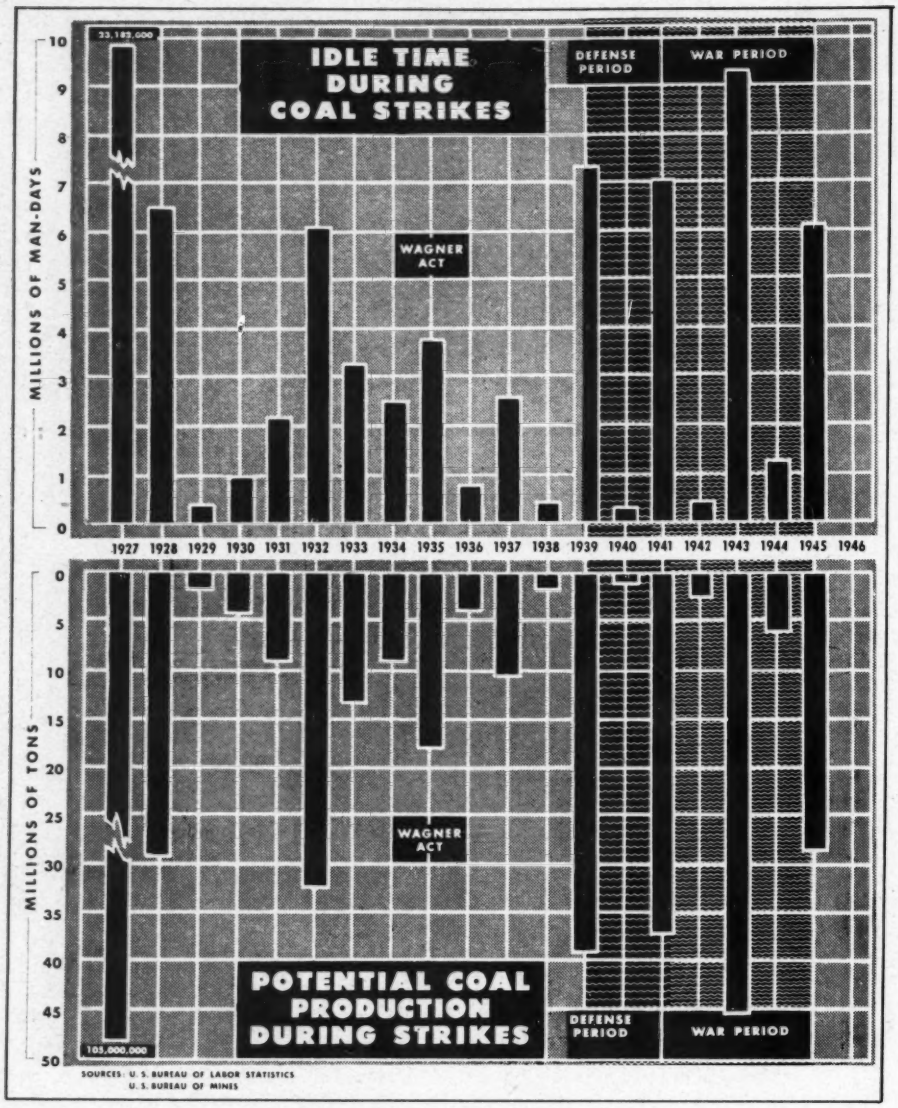
Production time lost during the 1927-1945 strikes totaled 72,743 man-days, of which 41,000 man-days were accounted for in 1945.

Production strikes in the natural gas and crude petroleum industries have not caused detectable interference with the public service. And, in addition to the valuable technical contributions of the industries during the war period, they continued producing and supplying natural gas and petroleum, without any interruption.

TABLE 1. PRODUCTION STRIKES IN THE NATURAL GAS INDUSTRY Combined with the Crude Petroleum Industry (1927-1945)

Year	*Strikes (Number)*	*Workers on Strike (Number)*	*Idle Time During Strikes (Man-days)*
1927	1	7	84
1928-32	0	0	0
1933	1	70	140
1934	3	1,484	12,878
1935	4	280	3,225
1936	0	0	0
1937	5	915	8,540
1938	1	8	932
1939	0	0	0
1940	0	0	0
1941	3	471	3,224
1942	3	142	2,047
1943	0	0	0
1944	2	102	673
1945	5	5,600	41,000
1927-1945 Total	28	9,079	72,743
Yearly average	1.47	477.84	3,828.58
BEFORE WAGNER ACT			
1927-1935	9	1,841	16,327
Yearly average	1.00	204.56	1,814.11
AFTER WAGNER ACT			
1936-1945	19	7,238	56,416
Yearly average	1.90	723.80	5,641.60
DEFENSE PERIOD			
1940-1941	3	471	3,224
Yearly average	1.50	235.50	1,612.00
WAR PERIOD			
1942-1945	10	5,844	43,720
Yearly average	2.50	1,461.00	10,930.00

Arranged from data compiled by United States Bureau of Labor Statistics.


IDLE TIME DURING COAL STRIKES
DEFENSE PERIOD
WAR PERIOD
WAGNER ACT
MILLIONS OF MAN-DAYS
33,183,000
1927 1928 1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939 1940 1941 1942 1943 1944 1945 1946
POTENTIAL COAL PRODUCTION DURING STRIKES
MILLIONS OF TONS
105,000,000
SOURCES: U. S. BUREAU OF LABOR STATISTICS
U. S. BUREAU OF MINES

Important in any consideration of labor relations in the natural gas industry are the largely personal relations between the labor force and management. Characteristically, workers producing gas and oil are native Americans, whose roots were set in the gas-oil areas during the pioneering years. The discovery of oil and gas attracted the most venturesome, and their sons have followed them into the industry. They are highly individualistic in thought, manner and performance.

It is not unusual to find that men in management positions, today, were in the labor force, not many years ago. Consequently, there is a strong element of personal relationship in the labor relations of the industry.

The unionization of workers producing natural gas and crude petroleum has not been measured precisely but was estimated at between 20 and 40% of the total workers, in the January, 1945, estimate by B.L.S. Unofficial estimates are toward the lower end of the Bureau of Labor Statistics bracket.

In general considerations, statistics dealing with industrial work stoppages, strikes and lock-outs, are important as broad indicators of unrest. However, there cannot be an overall measure that is satisfactory and understandable to all who are interested in the issues involved. The social, economic and political backgrounds of individual stoppages, together with the data that deal with the stoppages themselves, must be combined with evaluations of the results before significant interpretations can be made.

The term *stoppage* is used in the interest of accuracy. Almost all current stoppages, and those of the past several years, have been strikes by employees. There have been few lock-outs by employers since 1927, and they are believed to amount to less than 1% of all industrial disputes. None were so classified in the production of natural gas and crude petroleum.

There are some indications of a relationship between the general business cycles and the general strike trends, particularly since 1881. Usually, there are fewer strikes when the general business indicators decline and there is less demand for labor. Industrial difficulties increase when business is in an upswing. Factors that are outside the immediate bounds of labor-management relations, principally the political factor, influence the levels reached on the strike charts. The few strikes that have occurred in the production of natural gas and petroleum since 1927 cannot be regarded as clear trend indicators.

It is impossible to calculate an overall cost of a strike. The ever-widening circles of influence created by an individual strike reach and affect remote units of the economic structure.

The Coal Industries

The coal industries' persistent program of obstructing expansion of the natural gas industry makes it particularly appropriate to review, briefly, significant points in their history of labor relations, in an effort to evaluate their dependability as public service industries.

The most recent history of the combined bituminous and anthracite industries, 1927-1945, carries a total of 3193 work stoppages. It is reasonable to assume that almost all of those stoppages were strikes by the miners for higher pay, shorter working hours, improved working conditions, union recognition, or a combination of all.

The strikes of the 19-year period involved 4,599,733 workers who were idle for a total of 84,912,484 man-days.

From the earliest notes in the history of coal strikes in the United States, the workers have called upon the operators to improve working conditions, shorten hours, raise pay, and provide adequate protection.

First discovered mention of a strike in the fuel industries was in 1858 when coal miners in Monongahela Valley, Pennsylvania, struck against irregular sizes of coal cars and demanded scales at each pit for weighing each miner's coal. This strike failed to achieve its purpose after four months. The record of the event shows that women appeared in the picket lines and that 27 men and women were convicted for rioting.

There were a number of coal strikes during the war years of 1861-1865, during which there were comparatively few other strikes. The miners were generally successful, it was said, be-

cause of the currently rising coal prices.

Production in the Pennsylvania anthracite mines was practically stopped in 1868 when the miners demanded the immediate enforcement of the eight-hour law that had been passed in the Pennsylvania legislature during the same year.

In 1874 a strike of anthracite miners against wage reductions lasted seven months.

Coal strikes appeared in the histories of labor disputes through the years: 1894, 1902, 1912, 1919 and down to the more accurately recorded recent history which starts in 1927.

The *Twenty-first Annual Report of the Commissioner of Labor*, 1907, summarized the strike records for 80 industries in the 25-year period from 1881 to 1905, and included:

Industry	*Strikes*	*Workers*
Building trades	9,819*	1,329,461**
Coal and coke	3,403**	2,531,192*
Electric light and power	85	4,421
Gas (*presumed to be manufactured*)	48	5,618
Total, 80 industries	38,303	9,529,434

*Highest total
**Second highest total

The background of labor relations in the coal industries is one of continuing attempts by the miners to improve their lot, and the frequency and durations of the strikes over the years indicate that their demands, as they have been met, were hard-won.

In 1919, after the first World War, as in 1946, after the second World War, steel and coal strikes were in close proximity to each other. A strike by 367,000 steel workers was in progress in 1919 when 425,000 bituminous miners walked out.

Now, as this is written in 1946, almost at the very beginning of the reconversion effort, the bituminous coal industry is idle, approximately 400,000 workers are idle and no date has been set for their return to work. In 12 strike-days, 4,800,000 man-days of production were lost.

The hampering, sometimes crippling effects of coal strikes reach out farther each day. Industrial operations that try to depend upon the coal industries for fuel, are curtailed by efforts to stretch coal piles until deliveries are resumed.

The coal industries failed to meet their responsibilities as public service industries, during the strike periods, to the extent that there was a demand for coal that was not supplied.

The coal industries were not able to improve their positions of dependability during the defense-and-war period, 1940-1945. There were work stoppages then, as during other periods. In fact, the annual averages for the number of strikes and the workers involved were higher than for other periods.

Despite the extremely critical need for coordinated and full-capacity production, the coal industries' strikes accounted for idle time which, if it had been productive time, would have produced 119,159,000 tons of coal. An average of 19,810,000 tons were *not* produced each year of the defense-and-war period.

The economic implications of the strikes in the coal industries are pointed out, clearly, by the potential production of coal, bituminous and anthracite, during the idle periods of the coal strikes.

When the average daily production per miner (U. S. Bureau of Mines) is extended by the number of idle man-days during strikes, the potential coal production *during the strike periods* of the years 1927-1945 amounts to 392,614,000 tons. That is the tonnage that was *not* produced and for which, presumably, there was a demand on the part of the consuming public that had committed itself to burn coal, depending upon the bituminous and anthracite industries to produce and supply.

Some impression can be obtained from the potential production tonnages of the coal industries, bituminous and anthracite, during the strikes of significant recent periods.

Years	*Potential Coal Production During Strikes*
1927-1945	392,614,000
Before the Wagner Act 1927-1935	210,324,000
After the Wagner Act 1936-1945	173,290,000
Defense Period 1940-1941	37,491,000
War Period 1942-1945	81,668,000

The Wagner Act has not solved the labor management problems of the coal industries. The tables and chart in this article give special attention to the periods before and after the National Labor Relations (Wagner) Act was signed by President Roosevelt, July 5, 1935, and became law. The coal industries' history of strikes is a heavy precedent to overcome.

There is little, in fact or figure, on which to base a recommendation of the coal industries, operating dependably in the public service. But these are the industries that obstruct the orderly and economic progress of the natural gas industry with objections, lamentations and interventions before the Federal Power Commission.

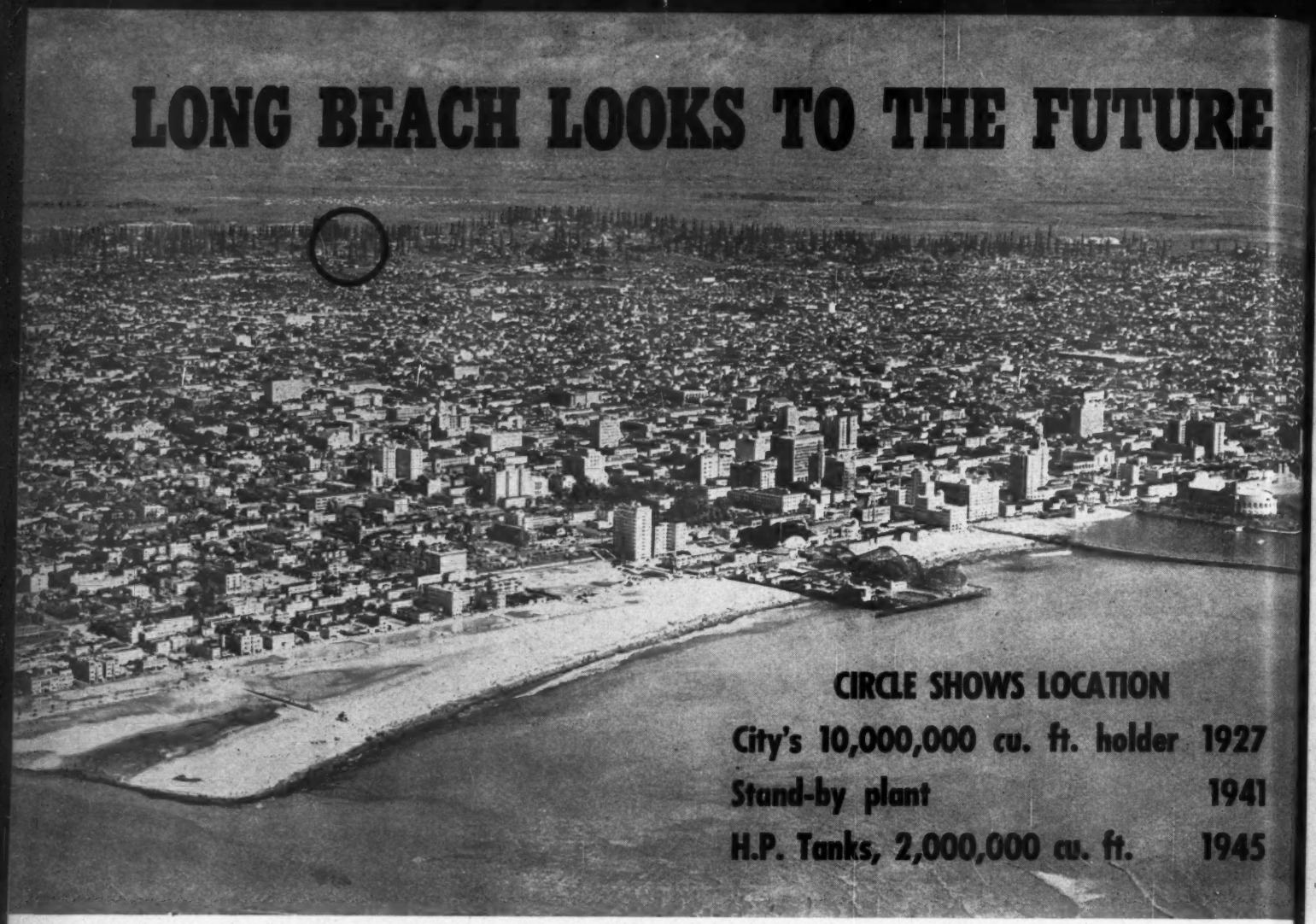
TABLE 2. STRIKES IN THE COAL MINING INDUSTRY

Anthracite and Bituminous Coal Mining, combined (1927-1945)

Year	*Strikes (Number)*	*Workers on Strike (Number)*	*Idle Time During Strikes (Man-days)*
1927	54	202,074	23,182,068
1928	71	141,703	6,514,396
1929	90	75,369	420,837
1930	70	46,877	999,937
1931	71	113,808	2,197,709
1932	61	83,211	6,080,922
1933	129	238,539	3,224,162
1934	116	215,123	2,511,125
1935	75	470,765	3,760,173
1936	64	42,721	797,859
1937	86	158,853	2,531,607
1938	44	35,921	490,709
1939	50	378,047	7,380,465
1940	59	41,727	258,695
1941	102	730,240	7,171,285
1942	127	79,927	490,389
1943	430	605,097	9,346,883
1944	853	270,531	1,383,263
1945	641	669,200	6,170,000
1927-1945 Total	3,193	4,599,733	84,912,484
Yearly average	168	242,091	4,469,078
BEFORE WAGNER ACT			
1927-1935	737	1,587,469	48,891,329
Yearly average	82	176,385	5,432,370
AFTER WAGNER ACT			
1936-1945	2,456	3,012,264	36,021,155
Yearly average	246	301,226	3,602,115
DEFENSE PERIOD			
1940-1941	161	771,967	7,429,980
Yearly average	80	385,983	3,714,990
WAR PERIOD			
1942-1945	2,051	1,624,755	17,390,535
Yearly average	513	406,189	4,347,634

Arranged from data compiled by United States Bureau of Labor Statistics.

LONG BEACH LOOKS TO THE FUTURE



E. S. Bryant

THE COMPLETION in April of the country's first all-welded, 5 MMcf telescopic type, water-seal gas holder and of four all-welded high pressure gas tanks for the Municipal Gas Department of the City of Long Beach, Calif., marks an important step in the progress and development of the gas utility industry on the Pacific Coast. This series of articles, which has been compiled by Mr. Bryant with the cooperation of the engineers and companies affiliated with this many-sided construction project, consists of six sections. The first, which deals with the Economics of the Long Beach Gas System, brings up-to-date a previous study by Mr. Bryant which was published in GAS for February, 1941. The remaining sections cover the design and erection of the low and high pressure holders and the construction of a 1000-hp compressor station and of a diethylene glycol dehydration plant. This comprehensive series is in many ways a guide for small and medium sized gas companies in anticipating and meeting the problem of providing facilities to balance the supply and availability of gas with a city's growing population trends and demands. Edwin S. Bryant entered the employ of the City of Long Beach in November, 1923, as Engineer of Design of the newly organized Municipal Gas Department, and has been Assistant Superintendent of the department since 1928.

THIS SERIES of articles covers the growth and development of a medium sized natural gas distributing utility and reveals the studies and action necessary by its directing heads to meet the increasing demands of a growing population. In 1924 when the City of Long Beach acquired the gas distributing facilities, the system consisted of 230 miles of medium pressure gas mains, 19,689 services, and 32,264 active meters, serving a population of 110,000. While growth throughout the years was continuous, it was greatly accelerated during the war period, and today Long Beach has a population of 250,000.

From a study of records of days of maximum demand and of peak hour send-outs up to March, 1944, it was predicted that by 1946 the Long Beach system would have 70,000 connected meters and a load per customer that would indicate demands as great as 41,000 Mcf per day with peak hours as high as 2800 Mcf under normal temperature conditions. From the examination of the records of 1944, it became apparent that a plan to increase the city's gas storage capacity was imperative. This is the story of the accomplishment of that plan.

The first article is a review of the history and economics of the Long Beach Gas System. The succeeding sections take up specifically the design and construction of the all-welded low pressure holder, the all-welded high pressure gas storage tanks, the compressor station, and the dehydration plant.

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2. All-Welded 5 MMcf Low Pressure Holder 43
Collaborators: Rudolf Kraus, welding engineer, Stacey Brothers Gas Construction Co., and Guy Corfield, technical editor, GAS

3. Design of All-Welded High Pressure Tanks 51
Collaborators: H. O. Hill, assistant chief engineer, Engineering Department, Bethlehem Steel Co., and R. W. Binder, chief engineer, Bethlehem Pacific Steel Corp. Fabricated Steel Construction

4. Erection Details of High Pressure Tanks 53
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5. 1000-HP Gas Compressor Station 57
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Collaborator: Harold W. Wickstrom, consulting engineer, Los Angeles

1. Economics of the Long Beach Gas System

By E. S. BRYANT

Assistant Superintendent, Municipal Gas Department

Long Beach, California

THE City of Long Beach, Calif., acquired the gas distributing system of the Southern Counties Gas Co. in the Long Beach area in May, 1924. The system consisted of approximately 230 miles of medium pressure gas mains, 19,689 services, and had 32,264 active meters connected to the system. The properties taken over were valued at $2,315,405.33 and, in addition to the distribution system, included the 500 Mcf and 2 MMcf gas holders, a compressor plant and miscellaneous other properties such as land, stores, office, transportation equipment, etc.

The system was composed of small diameter mains inherited from four privately owned and operated gas manufacturing companies which had, from time to time; entered this area in competition with each other. In consequence, therefore, the feeder mains were small and none of them had been installed with any thought, at the time, as to the future growth of this community, or of natural gas being available here.

Early History

In 1915, when the Southern Counties Gas Co. purchased the gas properties from the Long Beach Consolidated Gas Co., which company had absorbed the original systems, the source of supply was from a pipe line which extended from the gas manufacturing plant of the Southern California Gas Co. in Los Angeles to the Long Beach city limits on Willow Street west of Santa Fe Avenue. This terminal was connected by an 8-in. high pressure line to the Southern Counties Gas Co.'s storage and compressor plant which is now the city's gas plant No. 1.

In 1916 and 1917 high pressure gas transmission mains were brought into the southern district of the Southern Counties Gas Co.'s system by the Industrial Fuel Co., the source of supply being in the La Brea and Whittier oil fields. In 1921 and 1922 the Signal Hill oil field came into production and the local distribution system was fed directly from the gasoline absorption plants located adjacent to the city limits.

Between the time of the selling of the gas bonds in 1923 and the date when the gas properties were finally acquired by the city, May 24, 1924, the newly organized Municipal Gas Department expended $695,438 in the construction of 38 miles of new distributing mains, high pressure (30 lb.) feeders, and several district regulator stations. Following these installations the Gas Department retired or abandoned over 24 miles of small sized mains and hundreds of services in the old system which were in bad condition, and replaced practically the entire distributing system in the downtown area with larger pipe lines.

Unlike the privately owned gas company, the Municipal Gas Department did not have available to it any source of supply from high pressure gas transmission lines which are usually operated at from 75 to 150 lb. pressure. The maximum pressure of the gas available to the city from local gasoline absorption plants was, and is now, but 30 psi. It was decided, therefore, to maintain the distributing system at a maximum of 6 lb. and to install a feeder system to be operated at 30 lb. maximum which would ultimately encircle the low pressure distributing system and meet the demand by means of a series of district regulators or automatically controlled governors at strategic points as needed. The result of this planning is that there is now a system composed of 461.5 miles of medium pressure (6 lb.) mains fed through 41 district regulators from 50.5 miles of high pressure feeder lines which range from 8 in. to 20 in. in diameter.

Leakage Mitigation

By this method of gas distribution fluctuations in the pressures on the entire distributing system have been greatly improved (Fig. 1). Leakage has been reduced from 1.4 MMcf per mile of main per year to 672 Mcf per mile per year at the present time, or more than a 50% savings in the cost of leakage alone. In terms of percentage the Gas Department has reduced the unaccounted-for gas item from 15%, which was the loss when the properties were originally acquired, to but 5.7%, the average during the past five years. The weekly pressure charts indicate that the pressures carried on the original distribution system fluctuated from 12 lb. to 4 lb. This has been gradually improved so that today we can control distribution pressures, even during the winter months, within a one-half pound range and with a maximum of not over 6 lb., and are able to "boost" the

Public Utilities Building at the City of Long Beach, Calif.

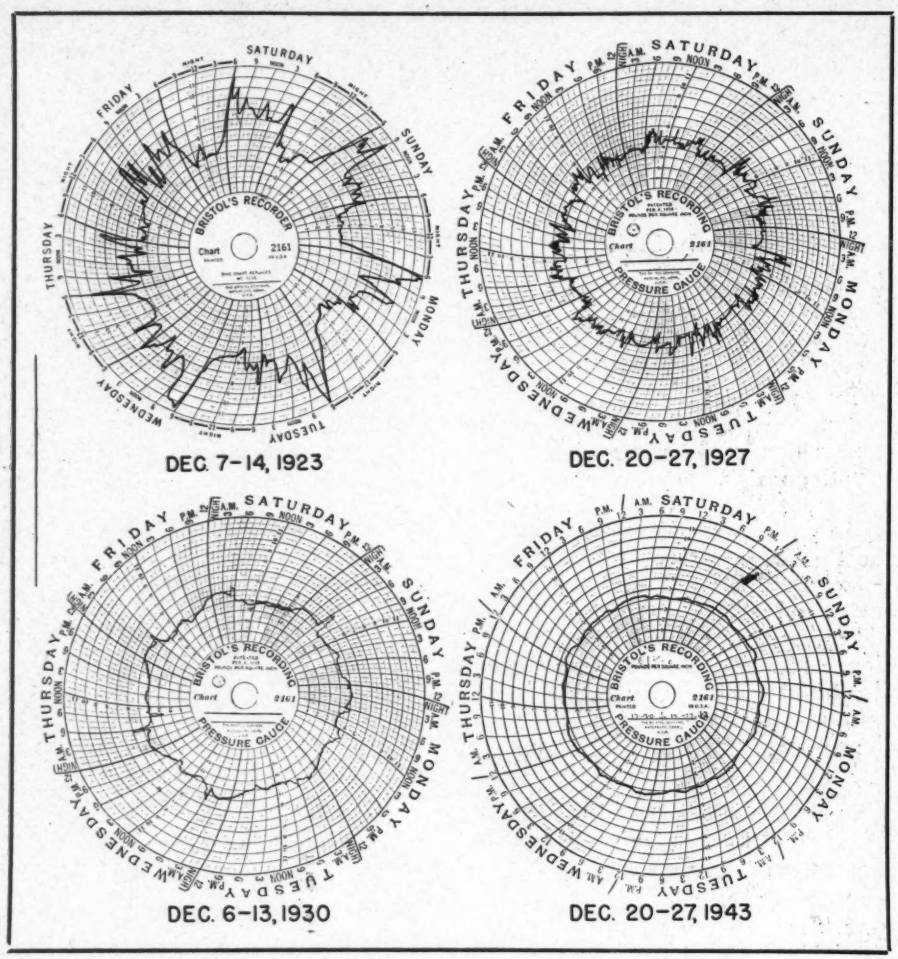


FIG. 1. Weekly charts showing improved control of pressure conditions on the Gas Department's distribution system, 1923-1944.

pressures in various distribution areas as needed during the heaviest demand from district regulators, without raising pressures on the entire system as was the method in the early days.

When the city acquired the gas distribution system of the privately-owned utility in 1924, the area within the city limits was but 18.14 square miles, and 32,200 active meters were being served within the cities of Long Beach and Signal Hill and small areas adjacent thereto, all of which territory was taken over by the newly formed Municipal Gas Department. Long Beach has gradually spread out and city limits today embrace 33.58 square miles or nearly twice the area served in 1924, while the number of consumers' meters connected to the system has grown to 68,000, or 111%. This increase of 35,800 meters, however, does not represent a true picture of the growth in the gas business during this 23-year period.

Early in 1925 the Gas Department was authorized to install master-meters in all apartment houses, hotels, etc., and render service under a commercial rate where the applicant could absorb a reasonable monthly minimum charge. This policy has been mutually beneficial and during the past four or five years many war and public housing projects have been built wherein the contract included all service piping inside the property lines and the Gas Department provided a master meter which supplies service to all housing units within the area.

In the westerly portion of the city 12 of these public housing projects which provide homes to 5365 families are supplied through 23 master meters. The city map, Fig. 2, shows the location of these various public housing projects.

We have in Long Beach at this time nearly 20,000 civilians employed at the many Navy bases, such as the Navy Hospital, Navy Air Base, Roosevelt Base, Navy Supply Depots and shipbuilding and repair yards on Terminal Island, all permanently located here. The civilians, as well as Army and Navy personnel, live in many of the new multiple units where but one master meter is installed. The increase, therefore, in the *number* of meters is not a correct index of the increasing demand for gas service. The total number of meters in 1940 was but 54,370, and today we have 68,000 active consumers connected to our system.

In the congested area shown as Zone "X" on the city map (Fig. 2) the number of meters has increased during the past six years by 2080; in Zone "Y" the meter count shows an increase of 6900 and in Zone "Z" 4650. In the entire area served by the Gas Department the increase in total meters since 1940 equals 13,630, or about 25%, whereas the population according to this year's census is 243,200 or 50% greater than in 1940.

In another section of this paper mention is made of the importance of furnishing the Office of War Utilities of the War Production Board with factual statistical data which was required to present and support the urgent neces-

TABLE 1. NATURAL GAS PURCHASES BY MONTHS, 1939-1945

Municipal Gas Department, Long Beach, California

MONTH	1939 M.C.F.	1940 M.C.F	1941 M.C.F.	1942 M.C.F.	1943 M.C.F.	1944 M.C.F.	1945 M.C.F.
January	484,852	477,361	495,983	555,233	646,089	771,735	878,679
February	468,052	426,645	453,613	516,948	492,527	752,481	745,032
March	442,787	363,355	419,428	520,133	503,358	638,810	852,860
April	297,162	298,953	413,773	453,763	407,078	549,558	667,631
May	273,771	237,184	302,234	376,162	367,184	487,664	574,825
June	213,429	227,372	284,221	319,580	344,983	402,699	499,522
July	209,503	239,600	267,285	278,271	326,202	391,470	442,223
August	226,627	262,971	278,484	310,049	388,119	401,224	435,309
September	213,924	246,708	282,397	328,112	396,278	408,630	424,954
October	254,155	300,173	376,108	391,044	481,026	513,588	508,609
November	315,227	398,861	420,033	472,668	541,807	660,731	737,126
December	407,327	457,339	557,237	596,464	704,526	790,484	898,326
TOTALS	3,806,816	3,936,522	4,550,796	5,118,427	5,599,177	6,769,074	7,665,096

WINTER PEAKS:

Maximum Day: February 28, 1945	36,480,000 cu. ft.
Maximum Hour: February 28, 1945—8 A.M. to 9 A.M.	2,303,000 " "
Estimated Peak Day 1945-46	40,000,000 " "
Estimated Peak Hour 1945-46	2,600,000 " "

sity claimed in our application for the release of a large quantity of "critical materials". As many of the claims made at that time (March, 1944) included a forecast of what facilities were needed to meet increased loads in the immediate future, it may be of interest to bring the tables, charts and diagrams accompanying and supporting the city's application to the War Production Board up to date.

Table 1 is a record of natural gas purchases, by months, from 1939 to 1946. This table includes the total annual receipts and a forecast of the maximum day and peak hour demand for the coming year.

Fig. 3 is a chart indicating the annual increase in sales to all firm gas users by years, 1930 to and including 1945.

Monthly Fluctuation in the Use of Gas

A very important graph (Fig. 4) shows the use of gas by all classes of consumers by months during the prewar period as compared with the sales of 1945-1946. This record of total gas requirements closely conforms to the estimates of future requirements as filed with the War Production Board in 1942. In the upper portion of this chart the curve showing the number of housing units within the territory served, closely parallels the volume of gas used in the home. Fig. 5 is compiled from the record of daily requirements for the four winter months, 1939-40, with those of the current year and the tremendous increase in the winter load in this six-year period is graphically demonstrated.

A series of charts similar to Fig. 5 over a period of several years indicating the daily gas requirements during the four winter months, December to March inclusive, impressed the engineers of the Office of War Utilities so much that the city's application for authorization to build additional plant and storage facilities to meet the rapidly increasing demands of the Gas Department was approved.

Days of maximum demand with peak hourly send-outs from records up to March, 1944, were also submitted to the engineers of the Office of War Utilities of WPB and charts were made forecasting the demand for gas in 1946 estimating that we would have 70,000 meters connected to the system. The load per consumer indicated the possibility of demands as great as 41,000 Mcf per day, peak hours as high as 2800 Mcf under normal temperature conditions within two years. (See "Forecasting Gas Sendout" Bryant and Knoy, *GAS*, July, 1944.)

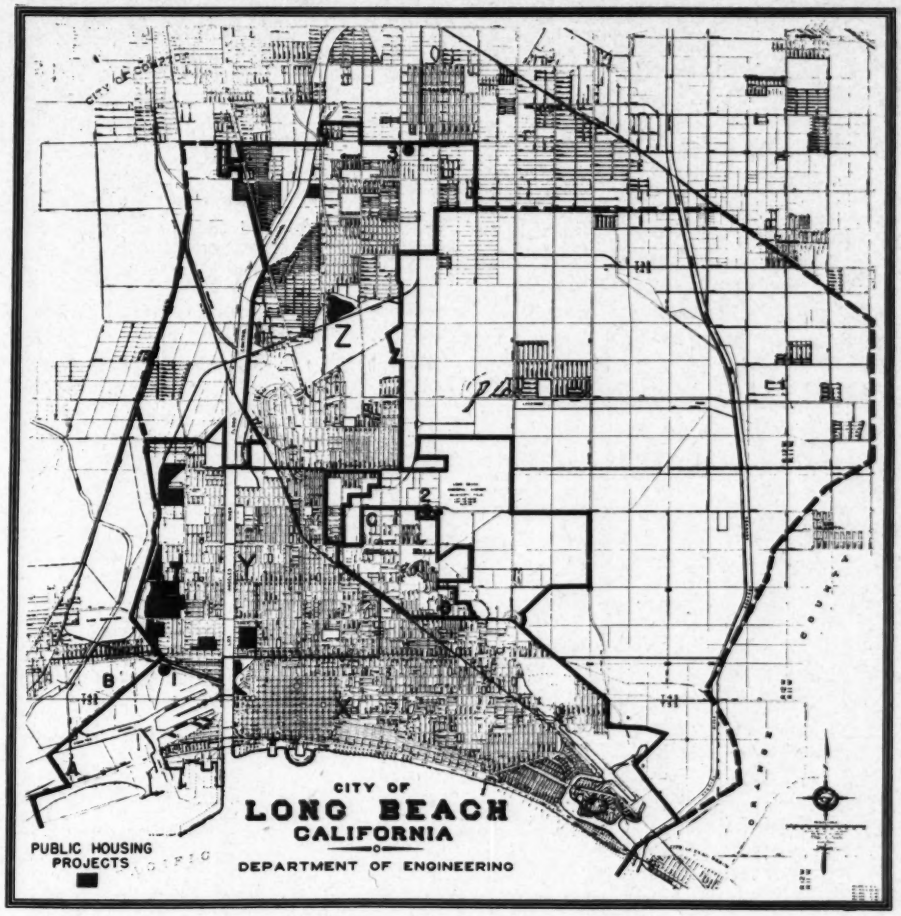


FIG. 2. Map of City of Long Beach.

With these charts we were able to prove that with the storage then available, it would not be possible to keep up with gas demands for essential use under the rate of growth we were experiencing.

Summer vs. Winter Loads

The widely fluctuating demand for gas that is customary throughout Southern California is depicted on the chart shown as Fig. 6 wherein we point out the *extremes* in hourly and daily gas service requirements, by comparing the three *coldest* days of the year with the three days wherein we had the *lowest* send-out, Sept. 1, 2 and 3 of last year.

Gas purchases throughout the year averaged 21 MMcf per day, whereas during the peak day which took place on Feb. 4, we distributed 38,586 Mcf, or more than 83% greater than the volume required on an average day. During the hot weather last summer gas consumption fell to as low as 9,244 Mcf per day which is less than one-half the send-out of the average day and only one-fourth as much gas as was required during this winter's peak.

In other words, the Gas Department must have supplies available to meet the heaviest demand that can reasonably be anticipated, which is at least 100% greater than is needed to meet the average daily requirements.

The peak hour this winter took place between 8 and 9 A.M. on Feb. 5, following the rains of the preceding days. During this hour we delivered 2679 Mcf, whereas the peak hour during the summer months falls to as low as 600 Mcf. During the midnight or off-peak hours in summer the entire load on our system is only 230 Mcf, or but one-twelfth as much as must be available to meet the hours of heaviest demand.

Extensions to Plant and Storage Facilities

Early in 1925 the Gas Department built a large compressor plant in the Dominguez-Rosecrans oil field and installed a high pressure transmission main from its No. 1 plant approximately 9½ miles into this field following the making of contracts for large volumes of gas, the Southern California Edison Co. agreeing to absorb all surplus that might be available.

In 1927, following a period of threatened shortage due to lack of

storage facilities, a bond issue was voted by the people and the Gas Department was authorized to build a 10 MMcf gas holder on city land on Signal Hill. This site was selected as the prospective center of distribution of the *future* Long Beach gas system by the department engineers.

The compressors that had been installed in the Dominguez and Rosecrans fields were available on account of the rapid depletion of the casing-head gas in that area and were moved to the site of the new holder on Spring Street at Junipero Avenue. A 20-in. feeder main was built west to Cherry Avenue, where it divides into three 12-in. headers. In 1941 a second 12-in. main was installed on Cherry Avenue. This was needed to meet the demands in the North Long Beach district. In 1942 a 12-in. feeder was laid east on Spring Street to Lakewood Boulevard where it divides into lines running north and south, the southerly line being extended to meet the load at the new Navy Hospital and boost pressures in the southeasterly distribution areas.

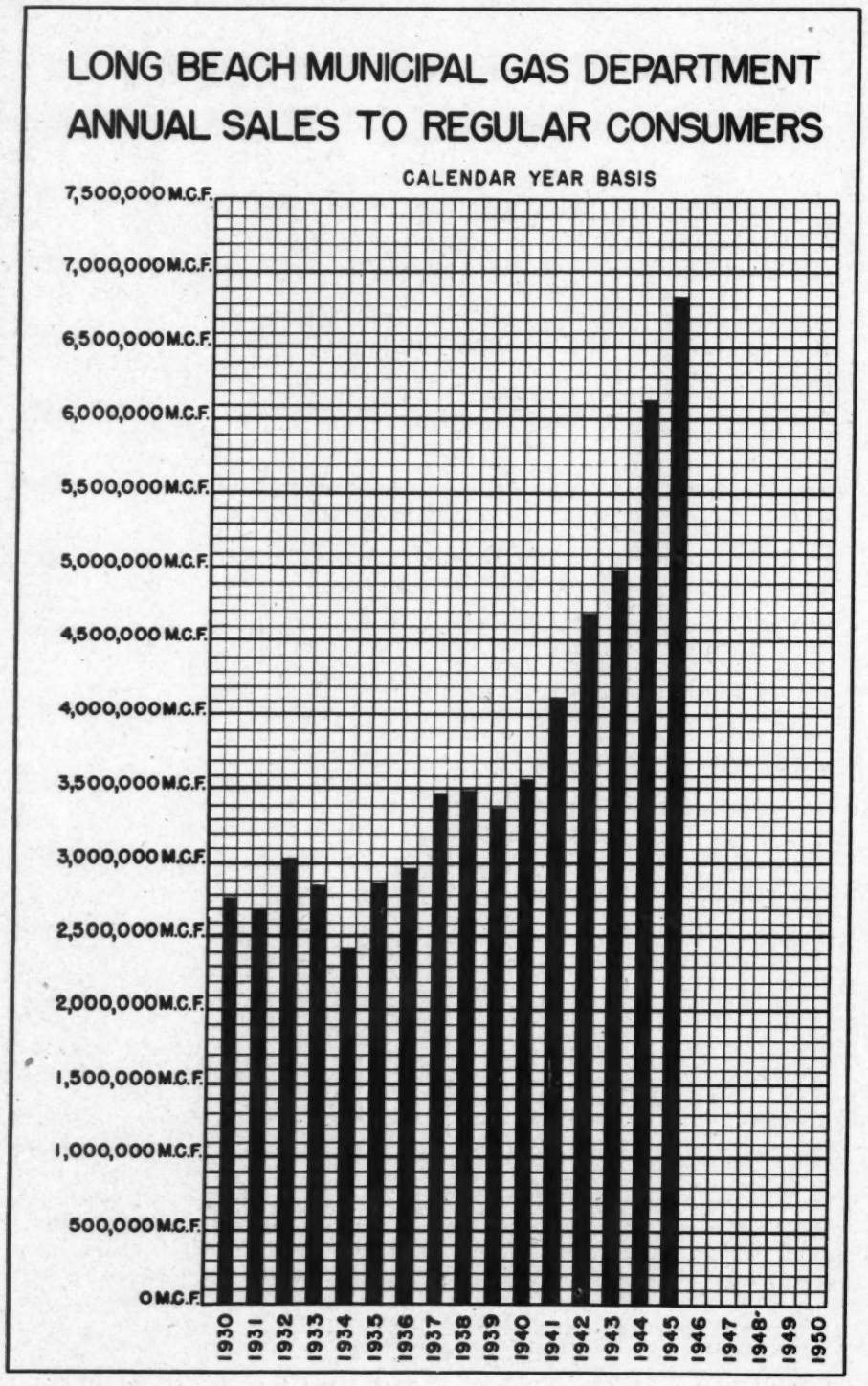


FIG. 3. Long Beach Municipal Gas Department annual sales to regular customers.

This line can be isolated from the feeder mains supplying the west and southwest areas, and will carry up to 50 lb. pressures as demands require.

By reference to the city map, Fig. 2, a general outline of the Long Beach area served today can be seen, the heavy solid lines representing present limits and the dash lines showing possible future growth.

Circle in photo, page 34 indicates the location selected in May, 1927, as the probable distribution center of the Long Beach system, at which point there is now a 10 MMcf low pressure storage holder, a 12-unit compressor plant with a capacity of 1 MMcf per hour; the LP-Gas air-mix standby plant which was installed in 1940-41 with a capacity of 450 Mcf per hour of 1450 Btu gas; and two 300 hp. gas compressors which have an output of 250 Mcf per hour at 50 lb. (See *GAS*, Feb., 1941, p. 21, for complete description of this standby plant.)

High Pressure Storage

The four new high pressure gas storage holders with a combined output between 50 psi and 10 psi of 2 MMcf are located adjacent to the standby plant and the interlocking gas headers between the high and low pressure storage and the standby plant have been so arranged, valved and regulated that the plant operators can fill or discharge from either low or high pressure storage, and at the same time manufacture butane or propane air-mix gas. High pressure gas can be discharged directly into the distribution header on Spring Street or can be diverted to augment the flow from the main compressor plant while pumping from low pressure storage. In other words, the piping arrangements installed with the 10 MMcf holder and plant in 1927, the standby plant headers built in 1941, and the high pressure storage tanks recently installed can be called upon to function as one unit or can be segregated, operating individually as gas supplies and the demand on the system requires.

As the new high pressure tanks are of all welded construction and exceed in diameter all other gas storage tanks on the Pacific Coast of similar design, a special illustrated article covering the design and erection details of these tanks will be found elsewhere in this issue. Reuben W. Binder, engineer of Bethlehem Steel Co., and Russell J. Love, chief engineer of the Southwest Welding and Manufacturing Co., each having contributed interesting and informative papers on their part in the building of these tanks.

In spite of the fact that the standby gas plant, erected in 1941, has a capacity in excess of 8 MMcf per day of natural gas equivalent, and the LP-Gas tanks were designed so that either liquid butane or propane can be held in storage, the problem of maintaining adequate supplies in the event extensive operations of this plant was necessary, called for further studies as our gas loads were rapidly increasing. Whereas the expense of manufacturing LP-Gas for emergency use can be easily justified, the rapidity of consumer growth throughout the Long Beach area between 1941 and 1944, knocked previous estimates of firm gas requirements out of line. As the supplies of gas available to the city had not been restricted in total, peaks and possible periods of very heavy demand faced the department which were much higher than had been previously anticipated.

Consequently, in March, 1944, applications were filed with the War Production Board for critical materials to the extent of 1700 tons of steel for high pressure storage and 2556 tons for a 5 MMcf telescopic type gas storage holder to be released so construction could start early in 1945. It was demonstrated by charts and sendout tables that essential gas consumers, in the event of any abnormal weather conditions, could not be assured adequate supplies with our present facilities and that additional storage was imperative.

Need for Added Storage

Whereas the standby plant would help in controlling peak loads, it was not designed to carry the increasing firm gas demands and, in consequence, considerable curtailment to war industries would have been required in the event of a shortage for domestic and commercial use. It was proved that whereas gas supplies on an hourly basis would possibly be ample with the present storage, to maintain regular service during extreme peaks or abnormal weather conditions, the very heavy growth of our system called for additional plant and storage facilities. It is less costly in the long run to pump gas out of storage than it is to manufacture high heat unit gas or to attempt to curtail or restrict supplies to customers who might be having difficulty in securing sufficient standby fuel oil to carry their heating loads.

The Gas Department was able, therefore, to demonstrate that the phenomenal growth in essential gas business in the Long Beach area demanded immediate relief.

City's application, following several months of investigation by the Office of War Utilities and Man Power Commission, was finally approved and the release of the necessary critical material was authorized. During the course of the investigation by OWU as to the necessity for prompt action on the storage applied for, it was brought out that "Authorization of Construction, Assignment of Preference Rating and Allotment of Controlled Materials" could not be granted on a wholesale tonnage basis but necessitated a complete listing of steel requirements by (a) description (b) sizes (c) weights and value of all the major items of materials needed, together with an estimate of the total man days that would be used for local or field erection, etc., etc.

OWU Approval Necessary

In the case of the four high pressure tanks this requirement, of course, was not difficult. Many tanks of similar design and capacity had been erected in Southern California during the past 10 years. As the City insisted upon tanks of *all* welded design (instead of part riveted), specifications governing the class and weights of the steel required in the construction had to be drawn up definitely enough to satisfy the Office of War Utilities.

For the low pressure telescopic type 5000 Mcf holder the steel listing details were far more difficult. The first consideration was the determination of whether we would specify (a) riveted fabrication, (b) all welded fabrication, or (c) combination of welded and riveted fabrication. The only thing we were sure of was the capacity we wanted; namely, 5000 Mcf.

The city had built but one holder, the 10 MMcf, five lift holder, in 1927, and it was assumed that the new structure could be built adjacent to the same site and thus use the two compressor plants available at that location, building the high pressure tanks further north to handle the loads in the new war housing projects then being developed. High pressure gas mains had been so arranged that the new tanks could be automatically filled and discharged to handle the demand on the distribution system feeding that district.

The 10 MMcf holder is located directly opposite Long Beach's municipal airport, but the structure was not in line with any of the take-off runways and the top of Signal Hill was in the immediate background. Permission was granted by the Civil Aeronautic Administration to erect a new holder 212 ft. in height just east of the 10 MMcf structure as not "introducing an unacceptable hazard to air navigation." City's Municipal Airport Commission, however, frowned on the location selected by the Gas Department as being a detriment to future air travel and, in fact, requested us not only to give up the idea of locating the new holder at that point but to consider the possibility of moving the 10 MMcf, 235 ft. high structure to a location farther from the airport.

Location plans and cost estimates had, of course, to be hurriedly altered with the result that a site for the 5 MMcf holder which would not be objectionable to anyone, was found at the extreme northerly edge of our system, disregarding the fact that soil bearing conditions were extremely bad and a large compressor plant would have to be installed to boost the gas into the high pressure transmission network. Fortunately funds had been set up in the department's budget for 1944-45 which were sufficient to handle the added investment required.

Engineering Services Retained

The engineering staff of the Municipal Gas Department of the City of Long Beach was not qualified to make foundation investigations and design the foundations for the 5 MMcf gas holder, the North Long Beach gas compressor station or for the four high pressure gas storage tanks; nor were we able to prepare the engineering plans from data and information available to the city.

It was deemed expedient, therefore, to employ the engineering services required to prepare the necessary specifications for the design, fabrication and erection on all the work we had planned to do at this time.

Soil bearing tests at the site of the 5 MMcf low pressure holder and compressor station in North Long Beach, together with an investigation of the structural characteristics of the soil at the Spring Street site of the high pressure tanks were arranged. Dr. Frederick J. Converse, associate professor of civil engineering, California Institute of Technology, made the field tests as well as the laboratory analyses and calculated the capacity of the soil at each location. Dr. Converse's conclusions were embodied in a complete report by the Donald R. Warren Co., foundation engineers of Los Angeles, which company prepared all the preliminary plans for the foundations which were included with the specifications.

In addition, this engineering firm prepared the final foundation slab, pil-

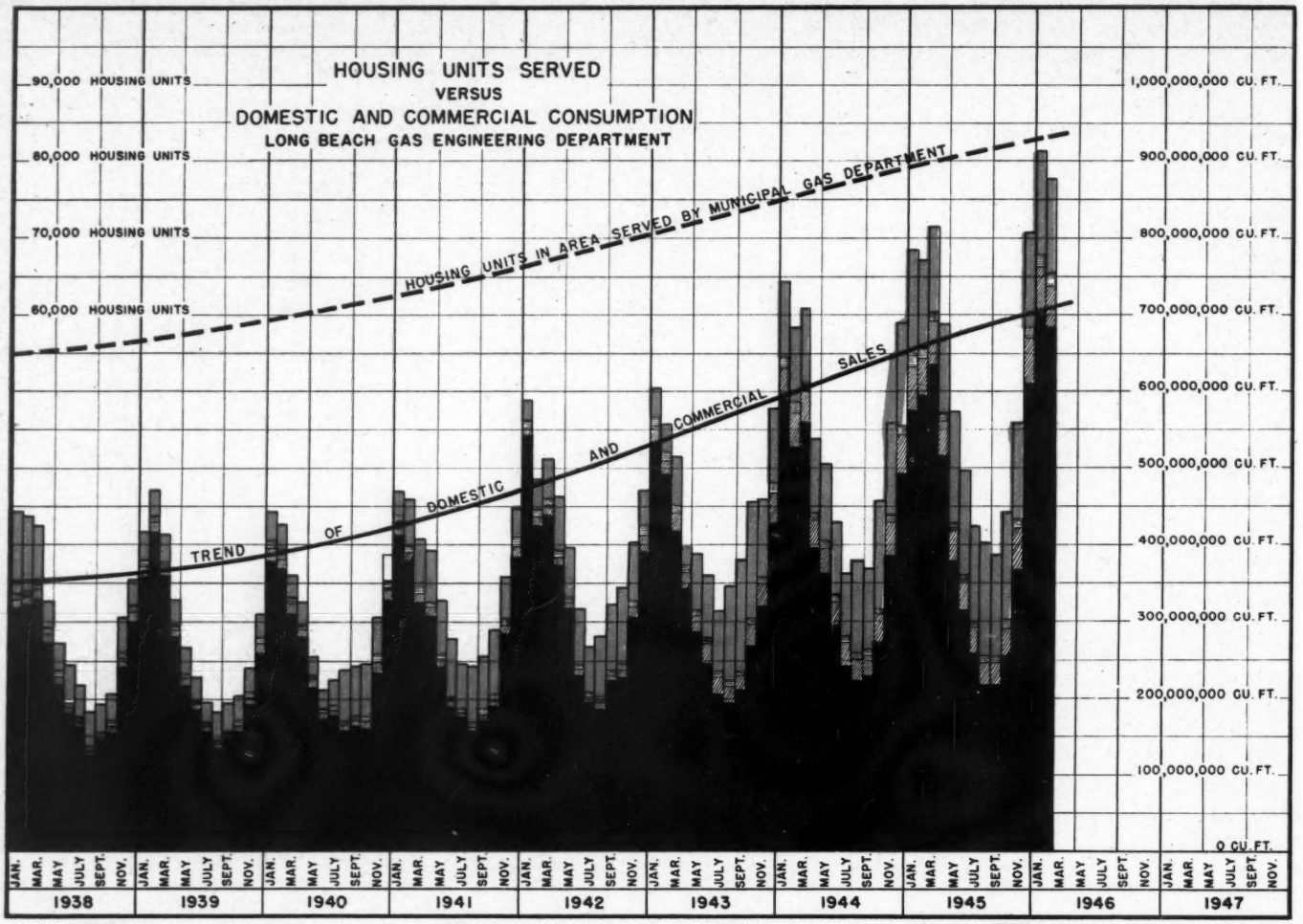


FIG. 4. Housing units served vs. domestic and commercial consumption.

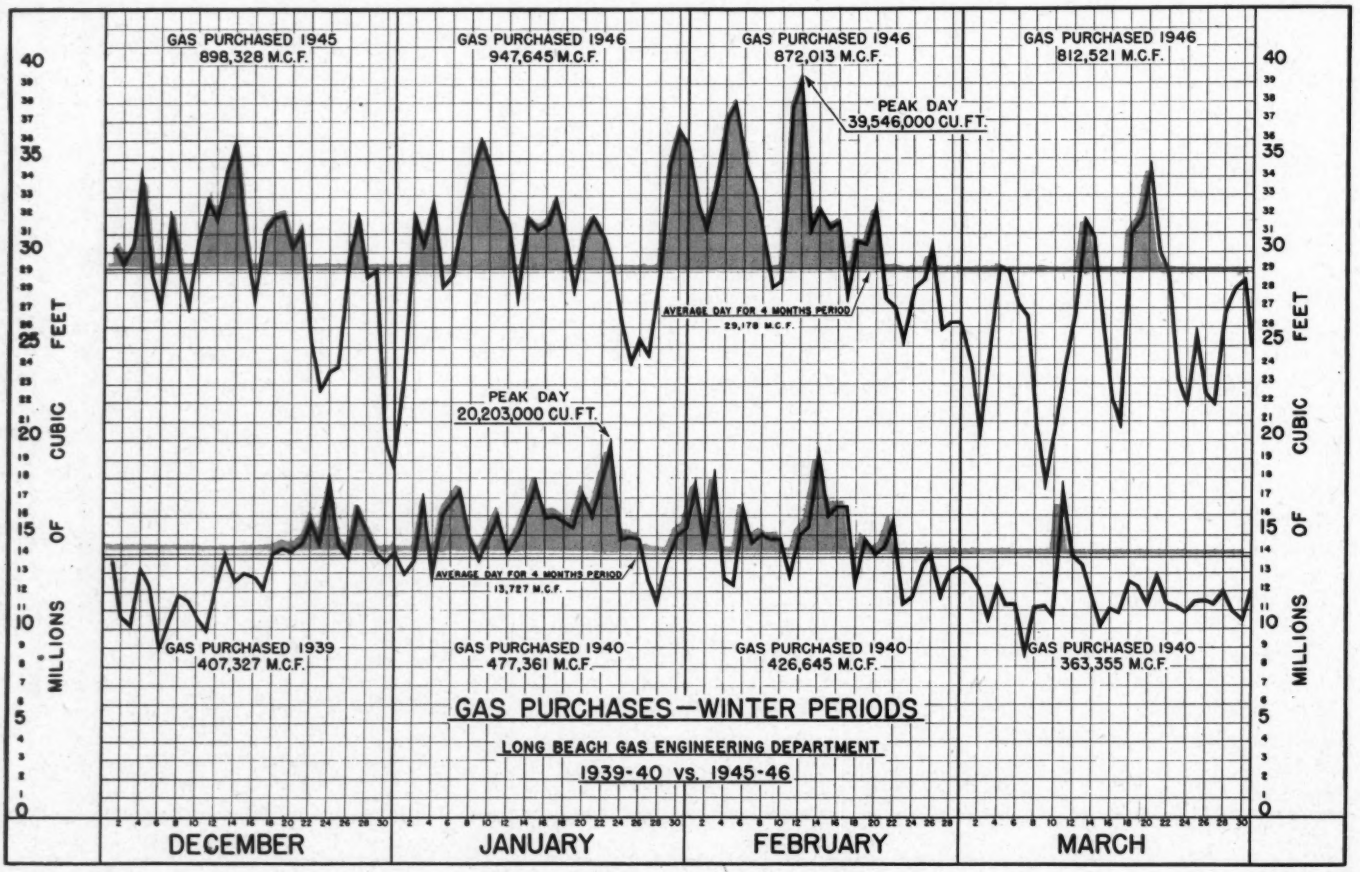


FIG. 5. Gas purchases—winter periods.

ing and structural details and drew up the specifications for this part of the 5 MMcf gas holder contract and supervised the construction of work.

The article on the low pressure holders was prepared through the cooperation of Rudolf Kraus, welding engineer, Stacey Brothers Gas Construction Co. and Guy Corfield, research engineer, Southern California Gas Co. and technical editor of GAS.

Russell J. Love, chief engineer, Southwest Welding & Manufacturing Co., Alhambra, contributed the section on the erection of the high pressure holders.

The foundation design and girder supports for the four high pressure storage tanks were also checked by Dr. F. J. Converse.

Harold O. Hill, assistant chief engineer, fabricated steel construction of the Bethlehem Steel Co. at Bethlehem, Pa., engineered the design and specified the method of fabricating the four high pressure storage tanks. Mr. Hill has been a member of the American Welding Society Executive Committee for many years and is chairman of the API-AWS Conference Committee on the Welding of Storage Tanks, etc., and is a registered structural engineer n the State of Pennsylvania. R. R. Martel, professor of structural engineering, California Institute of Technology, was employed by the City to make an analysis of the stresses in the high pressure tanks. Reuben W. Binder, district engineer, Bethlehem Steel Co., Los Angeles, at the request of Prof. Martel revised the shear button details, together with an elaboration of the column rocker detail, increased the size of the inner flange plate of the ring girders and also initiated certain changes in the footings and other structural elements, all of which were changes from the original design and were recommended by Prof. Martel as being beneficial and improvements to the job.

The compressor station was designed and specifications drawn up by Guy T. Martin, consulting engineer, Los Angeles, who also was in complete charge of the erection and supervised the many details of the construction of this plant.

The city's diethylene glycol dehydration plant, built in 1945, was designed and the erection supervised by Harold W. Wickstrom, consulting chemical and mechanical engineer of Los Angeles.

Robert W. Hunt Co., Chicago, was selected to supervise and inspect all steel construction in both the low pressure and the high pressure holders. Their work included both shop and field inspection, tensile tests, bend and nick tests of welds, conducting all tests of welders and following up all welding details in accordance with the API and AWS codes. This company also suggested the magnaflux method of checking welds on the high pressure tanks.

The American vacuum seam tester for the location of leaks in any seam, a patented device for the positive detection of leaks in the welded seams in bottom of water tank of the low pressure holder was used by the Stacey Bros. Gas Construction Co. and the tests checked by the Hunt Co. engineers.

The purging and placing of both the high and low pressure gas holders into service were carried on strictly in accordance with the procedure recommended by the A.G.A.

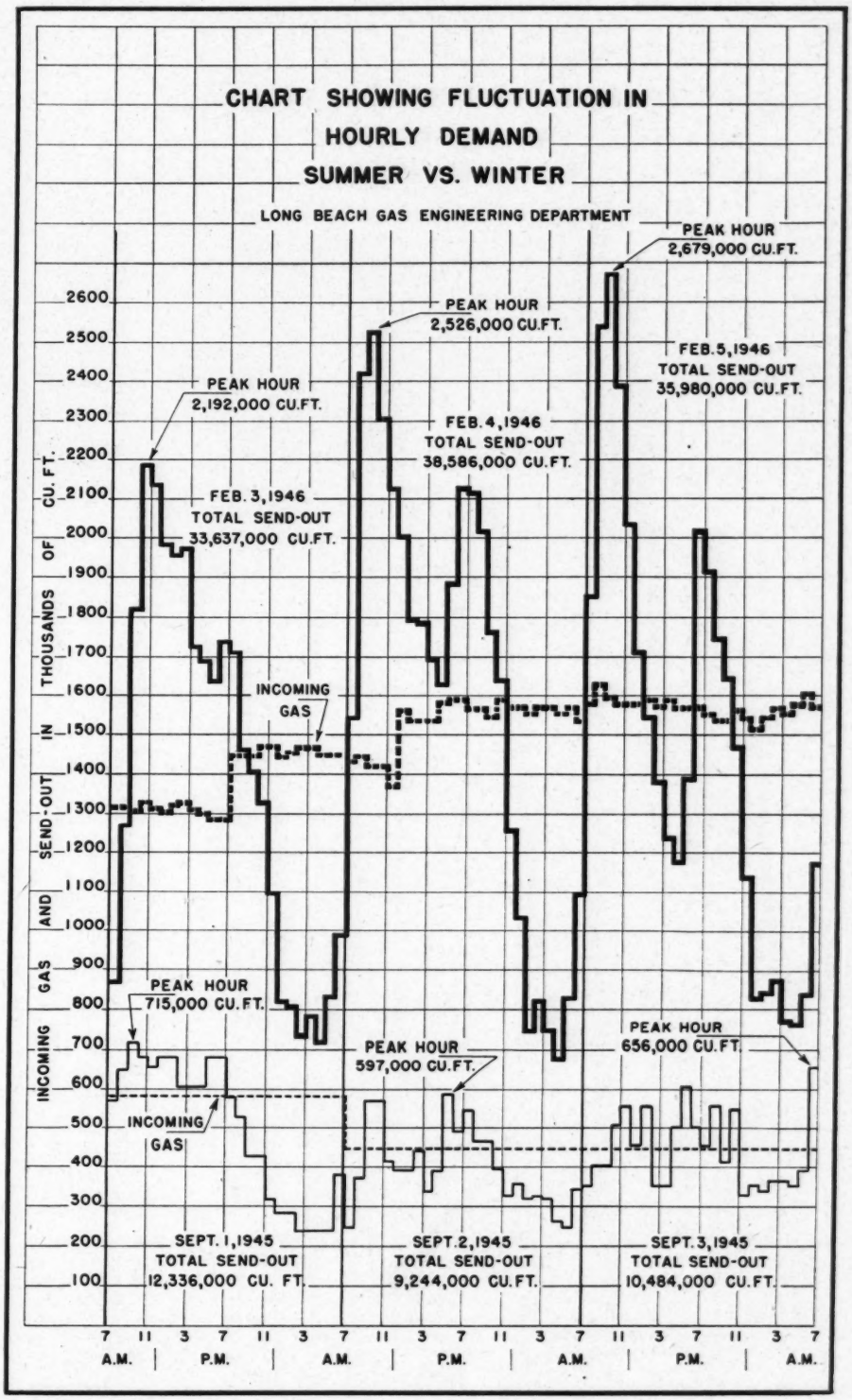
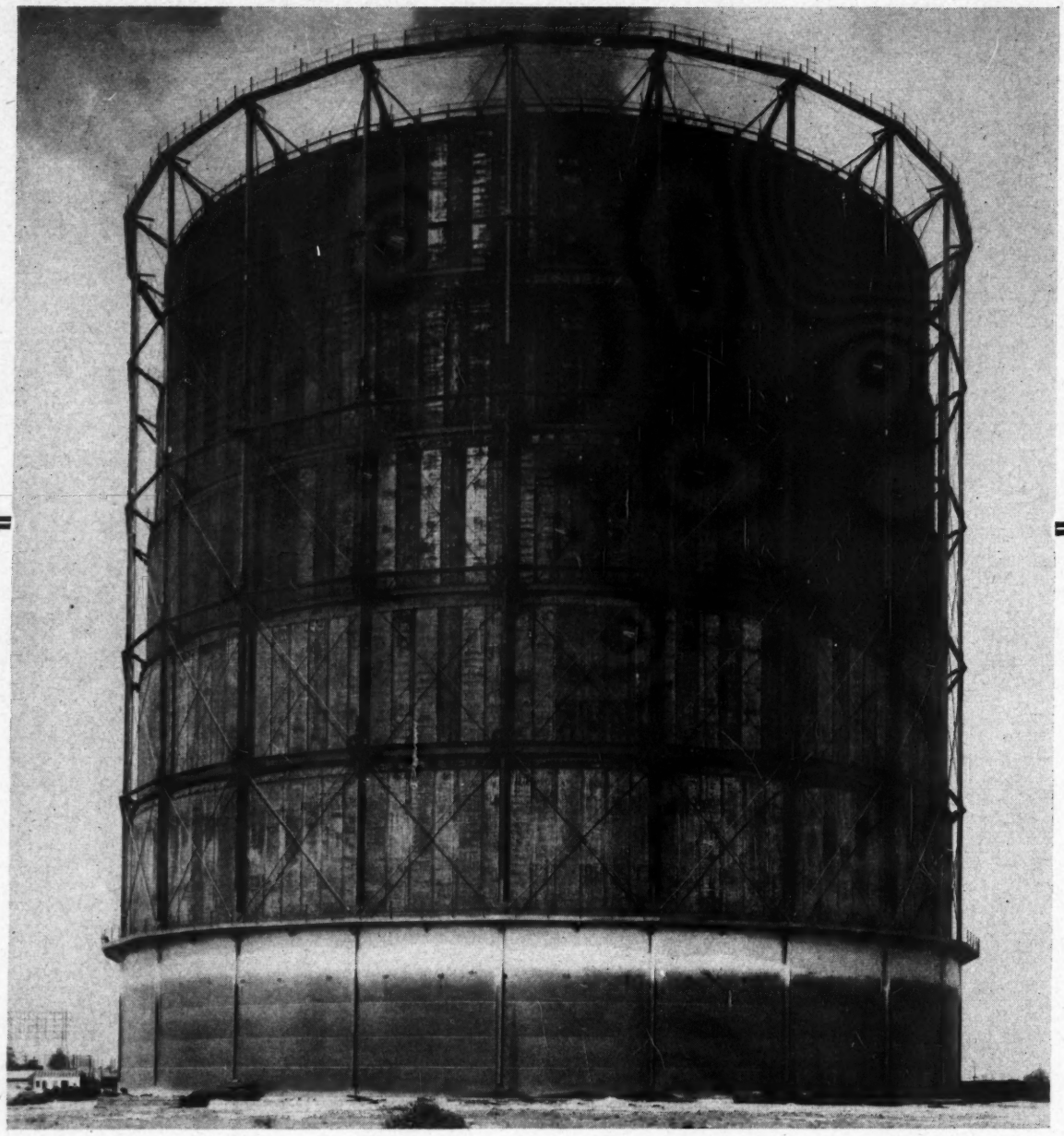


FIG. 6. Chart showing fluctuation in hourly demand—summer vs. winter.



AT LONG BEACH . . . . LARGEST OF ITS TYPE

A Stacey Brothers Installation

Here's a 5,000,000 cu. ft. Wet Seal Holder —*the largest All-Welded Panel Type installation in the United States!*

This is the third Stacey Brothers holder for the City of Long Beach—another important endorsement of the famous Stacey Brothers patented design.

All-Welded Panel construction saves on original investment, on erection time—*and on maintenance expense.*

You may never need capacity as large as this Long Beach installation—but our experience in the design, fabrication and erection of wet seal holders covers every size from 100 cu. ft. up. This experience can be valuable to you when you want long life and dependable holder operation. May we talk over your requirements with you?

STACEY BROTHERS
GAS CONSTRUCTION CO.
One of The Dresser Industries

5535 Vine St. **Cincinnati 16, Ohio**

Stacey Brothers TANKS

2. All-Welded 5 MMcf Low Pressure Holder

THE much needed 5 MMcf, telescopic type, five-lift all-welded wet seal gas holder, including foundation, is being erected on a five acre tract at Long Beach, Calif., by Stacey Brothers Gas Construction Co. of Cincinnati, Ohio, at a cost of $632,000. This installation is being made on account of the increased demands for the use of gas for residential and industrial heating in this area.

This gas holder (Fig. 1) is the third constructed in the City of Long Beach by Stacey Bros. The first one, a 2 MMcf unit built in 1921 and the second, a 10 MMcf unit built in 1927, were both of riveted construction. The new unit incorporates all the latest designs embodying among them the use of long holder panels, replacing the customary intermediate sheets and is entirely of welded construction. In the intervening years since the erection of the riveted holders, rapid strides have been made in all-welded gas holders, which entirely eliminate the obsolete methods of connecting various members and adds at least 25% to the life of the structure. The simplicity of welded construction has made it possible to eliminate many details of fabrication necessary in the design of riveted construction. Corrosion is kept to a minimum and maintenance costs are reduced as much as 50% by using welded construction.

This particular installation is unique in being the world's largest all-welded panel type water seal gas holder. This all-welded type of construction will be gone into in considerable detail. Other special and interesting features of the project include the unusual foundation details, the computation and design for resistance to earthquake stresses, and the inspection method employed to insure satisfactory construction.

Foundations

The first problem encountered at Long Beach was the poor drainage facilities at the erection site. The irregular high water table of the area required extensive calculations to determine the bearing capacity of the soil. In order to keep rain away from the base of the gas holder and to prevent any possibility of corrosion, it was necessary to raise the yard level 3 ft. above the existing grade. The work of grading and filling the site of the holder and the compressor building, which will house four Clark Bros. Co. compressors, required 25,000 cu. yds. of compacted material.

A complete foundation investigation in order to provide a sound basis for the safe and economical design of the foundations for the 5 MMcf low pressure gas holder was made under the supervision of F. J. Converse of the Donald R. Warren Co. at the California Institute of Technology Soil Laboratory, Pasadena, Calif.

To insure a permanent base for the 2335 ton steel structure and the 8,700,000 gal. of water contained in the 204 ft. diameter steel tank, many piles had to be driven to predetermined levels.

The foundation was constructed as follows:

Center—734 pre-cast concrete piles 14 in. x 14 in. x 37 ft.-0 in. long. These piles consisting of 1338.5 cu. yd. of concrete with 95.6 tons of reinforcing steel were driven with a No. 11-B-3 McKiernan and Terry steam hammer.

Outer Ring—288 cast-in-place #11 gauge monotube piles 14 in. diameter butt, 8 in. tip, 40 ft 0 in. long. Concrete in these piles amounted to 240.5 yd. with 8.0 tons of reinforcing steel in the upper 10 ft.

Slab—The 12-in. center slab, the outer 18-in. ring, and the two pits for the 30-in. inlet and outlet connections contained 1451 cu. yd. of concrete and 108.2 tons of reinforcing steel. The Hunt process of curing the concrete surface as provision against cracks caused by changing temperature conditions was used.

Pre-Cast Piles and Concrete Aggregate

The reinforced concrete piles were cast directly at the site and were given a 26-day curing time before driving was started.

The special concrete mix in piling and slab as specified by Herbert E. Goodall, city chemist, was as follows:

Class "A" Transit Mix

1311 lbs. sand
1102 lbs. #2 (small) gravel
946 lbs. #3 (U.S.E.D.) gravel
6 sacks Victor Cement
Proportions—1—2.4—3.4
6½ gal. water to 1 sack cement,
2 in. slump

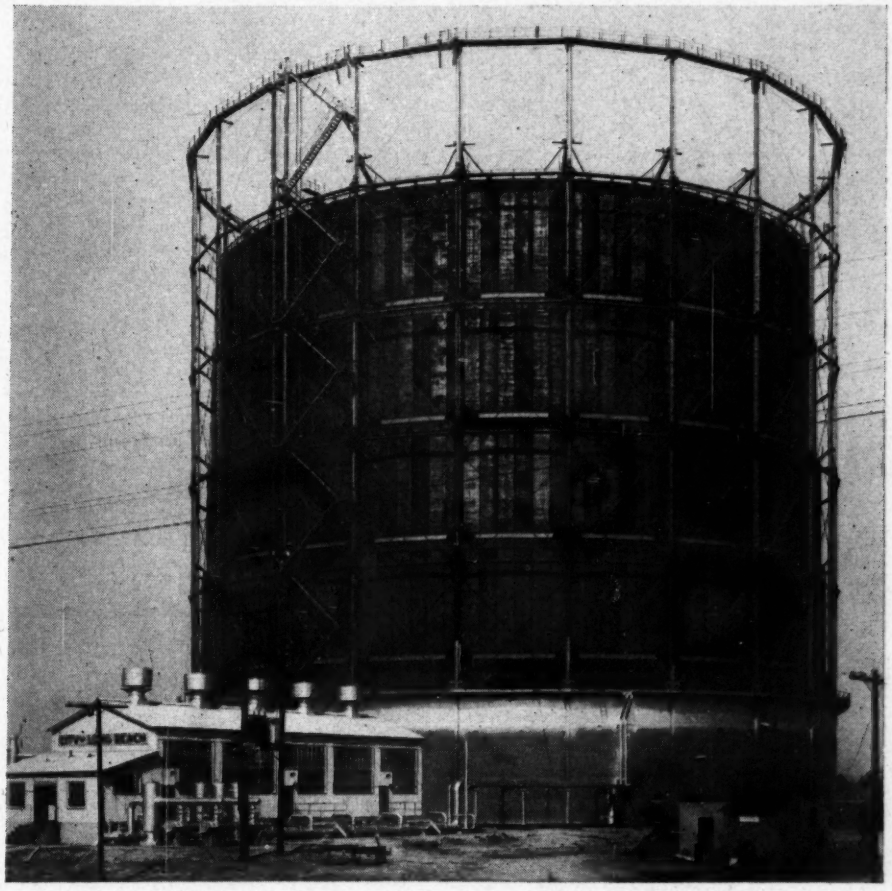


FIG. 1. Completed holder showing panel type of construction and walk-around on top of girders. The guide frame and tank will be painted aluminum and the lifts treated with gas holder oil.

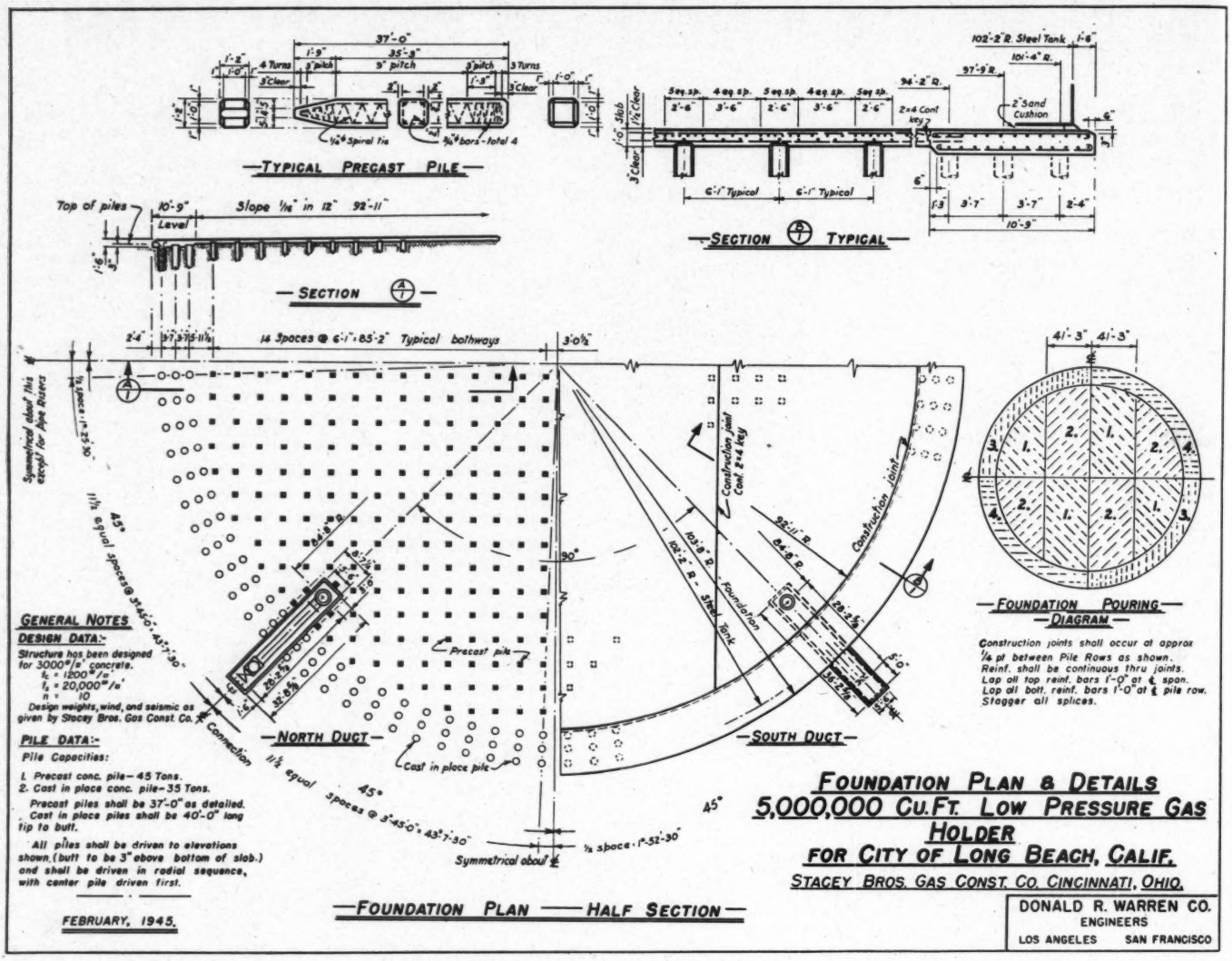


FIG. 2. Foundation plan and details.

Samples of the concrete tested at the city laboratory at seven day intervals showed compressive strength averaging as follows:

Age (days)	7	21	28	60
Psi	2794	4183	4621	5241

The depth to which the piles were to be driven and their bearing capacity was determined in the office. This was possible since shear test had been run on undisturbed samples of the subsoil. The shear values given in tons per square foot were determined by using a direct shear machine of the strain control type, thus giving a direct measure of the structural strength of the subsoil. From this information, the piles were designed to sustain their support by skin friction.

The center portion of the gas holder foundation was made up of precast piles, while the outer rings were monotube. To get maximum penetration of the piles, the driving commenced from the center and worked out to the outer rings.

No dynamic pile driving formula is satisfactory under all conditions, but the Hiley formula checked closely with design penetration, while the *Engineering News* formula gave results twice that of the design requirements which was 35 tons for a 40 ft. depth.

Modified Hiley Formula:

$$R = \frac{12\,WH\,(W+.1P)}{(W+P)} \Big/ \left(S + \frac{2400\,LR}{AE}\right)$$

R=Resistance to driving in tons.
W=Weight of ram in tons.
H=Height of fall of ram in feet.
S=Penetration per blow in inches.
L=Length of pile in feet.
A=Area to pile in square inches.
E=Modulus of elasticity of the pile in pounds per square inch.
P=Weight of pile in tons.

Engineering News Formula:

$$L = \frac{2E}{S+.1}$$

L=Bearing capacity of piles in pounds.
E=Energy or foot pounds per blow.
S=Average penetration in inches per blow for last few blows.

The equipment used for placing and driving the pre-cast piles was a 50 B Bucyrus Erie Steam Crane with a 60 ft. boom, 50 ft. hanging leads and a No. 1 Vulcan Hammer. This hammer proved to be inadequate and as jetting was not permitted, it was necessary to replace the Vulcan Hammer with a 11 B3 McKiernan Terry double acting hammer and driving proceeded at a satisfactory rate after that time.

The speed under which the 11 B3 M T hammer was operated averaged 95 blows per minute and created 19,800 foot-pounds per blow. The last 18 ft. of driving on the pre-cast piles was very slow and as the maximum penetration per blow averaged less than ⅛ in., it was calculated that the bearing of the piles in this 18 ft. strata was between 85 and 90 tons, or about double actual requirements.

On the outer ring of the foundation 288—14 in. x 11F Monotube piles 40 ft. long were required, and a 10B3 McKiernan Terry pile hammer was found to have ample driving capacity.

An attempt was first made to drive the monotube piles without jetting. This was found to be impossible since long before the desired penetration was reached, the force of blow required would crimp or buckle the piles. Jetting was then authorized and by experimenting with a few more piles, it was found that jetting to a depth of 25 ft. to 30 ft. was required for efficient progress and that the additional driving beyond the maximum depth of jetting was sufficient to bring the piles to final penetration with a bearing value in excess of 35 tons required by design.

Once established, the procedure throughout the rest of the job consisted of driving the piles without jet until resistance was encountered at approximately the 20 ft. penetration. Driving was then suspended and the jet run down its entire length, and removed. Driving was then resumed until final penetration was achieved.

Bearing at cut-off penetration was always 5 to 10 tons in excess of design value.

This procedure proved to be more rapid than jetting simultaneously with driving, since it was difficult for the men to hold the pipe against the pile while the latter was being struck.

At no time was it permitted to jet prior to inserting the pile.

The contract for the placing of the foundation, furnishing and driving the piles, and the ducts for inlet and outlet connections was carried out by the Long Beach Division of the Guy F. Atkinson Co., under the supervision of the Donald R. Warren Co.

The total concrete used in the foundation structure, including the 1022 piles, consisted of 3030 cu. yds., with 211.8 tons of reinforcing steel contained therein, and should be adequate against all possibilities of settlement.

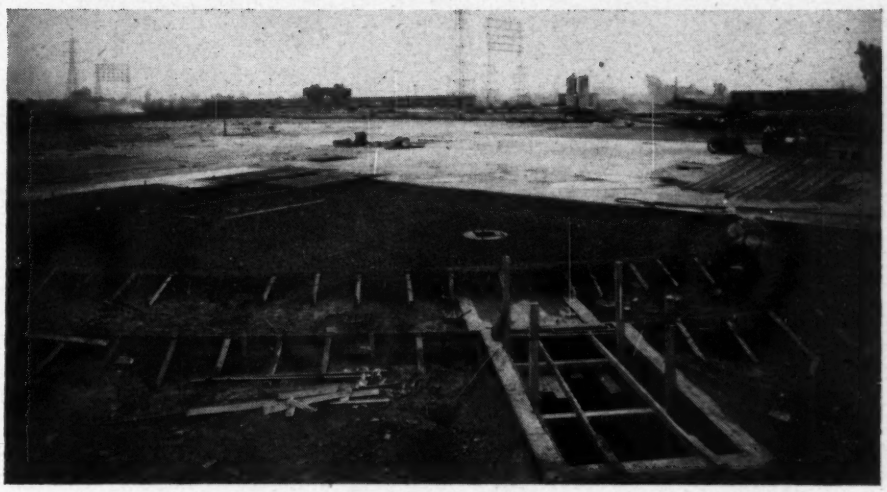


FIG. 4. Reinforcing and other details of construction of concrete slab superimposed on piling for holder foundation.

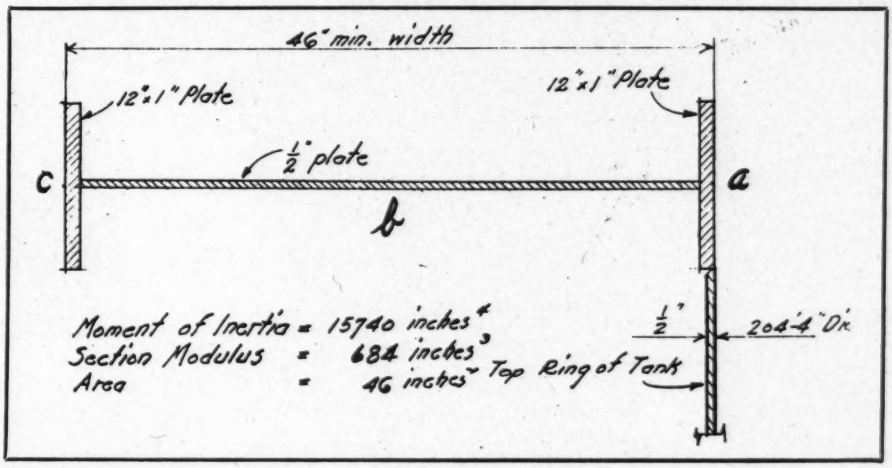


FIG. 5. Design of steel tank top walk girder to resist earthquake stresses.

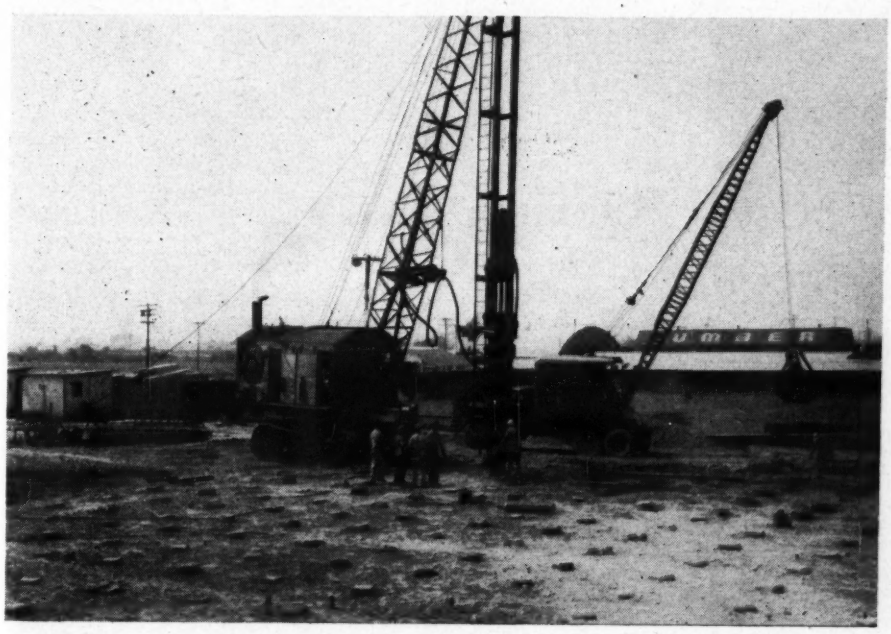


FIG. 3. Driving piling for the holder foundation.

Fig. 2 shows this foundation plan and details; Fig. 3 shows some of the driven piles and one being driven; and Fig. 4 indicates the manner in which the reinforced concrete mat was superimposed on the piling.

Earthquake Stress Resistance

With respect to resistance to earthquake stress, the Long Beach Building Code requires that structures be designed to resist stresses produced by lateral forces. In determining the horizontal force to be resisted, the following formula shall be used:

$$F=CW$$

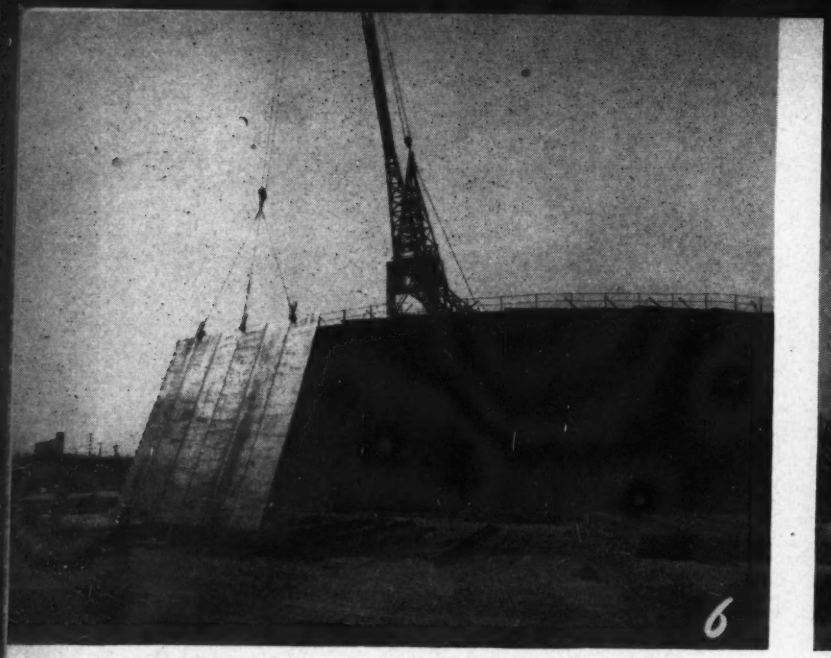
Where

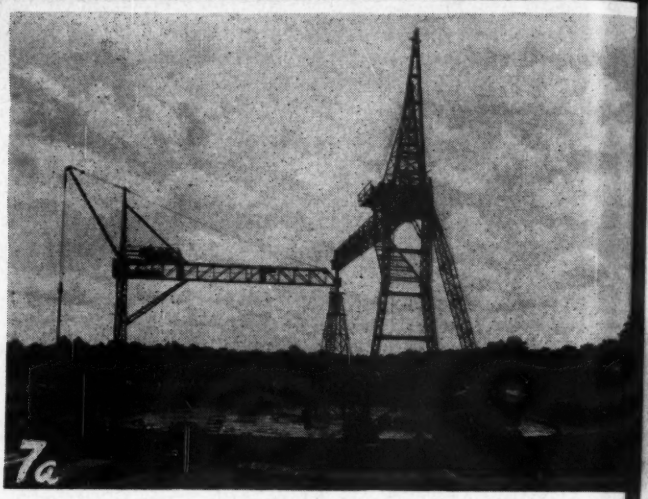
F=the horizontal force in pounds
W=(in the case of tanks, etc.) the dead load of the tank plus contents
C=0.08

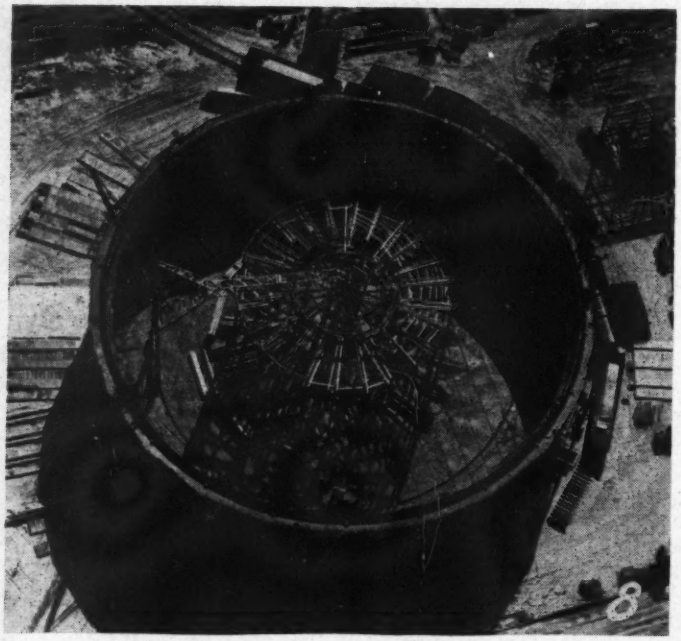
The forces caused by an earthquake acting on the water filled holder tank are: (a) the inertia of the holder itself, and (b) the force exerted by the inertia of the water in the tank.

The inertia of the tank is uniformly distributed around its circumference.

The force exerted by the water of







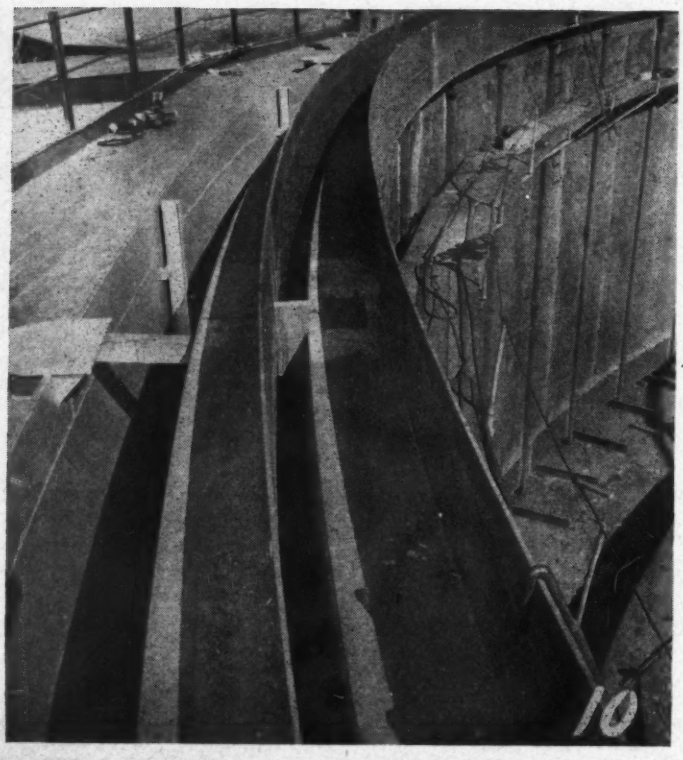


FIG. 6. Showing the large pre-welded "Panels" used in constructing the vertical lifts or sections.

FIG. 7. Showing commencement of the erection of the tank shell, with the construction crane pivoted on the permanent center post and revolving on a circular track laid on the bottom plates at the inside edge.

FIG. 7A. Two trammels necessary for erection of the riveted holder in contrast to Fig. 7.

FIG. 8. Showing the tank virtually completed; also the center post, crane and a portion of the permanent wood framework that is later used to support the crown.

FIG. 9. Showing wooden supporting framework completed and outer rows of crown sheets in place.

FIG. 10. Showing a close-up view of a section of the completed tank and the two outer intermediate sections or lifts.

a reservoir of indefinite extent upon a straight dam has been calculated by H. M. Westergaard and presented in a paper, "Water Pressures on Dams During Earthquakes," (*Trans.* Amer. Soc. C. E. Vol. 98 (1933) p. 418.) The adaptation of Westergaard's analysis to a circular tank was made by the Stacey Brothers Gas Construction Co., with Professor Clyde T. Morris, Professor of Civil Engineering, Ohio State University, acting as consultant.

The top walk platform of the holder tank, consisting in cross section of (a) a 12 in. x 1 in. vertical plate welded to the top of the top ring of the tank, (b) a 45 in. x ½ in. horizontal plate (providing the actual platform) welded to the center of vertical plate (a), and (c) an outside 12 in. x 1 in. vertical plate welded at its center to the outside edge of the horizontal plate (b), was designed to be (in effect) a circular I-beam girder to transmit the shear, due to the horizontal forces, to the tank shell and also serves to hold the top of the tank circular. This construction is shown in Fig. 5.

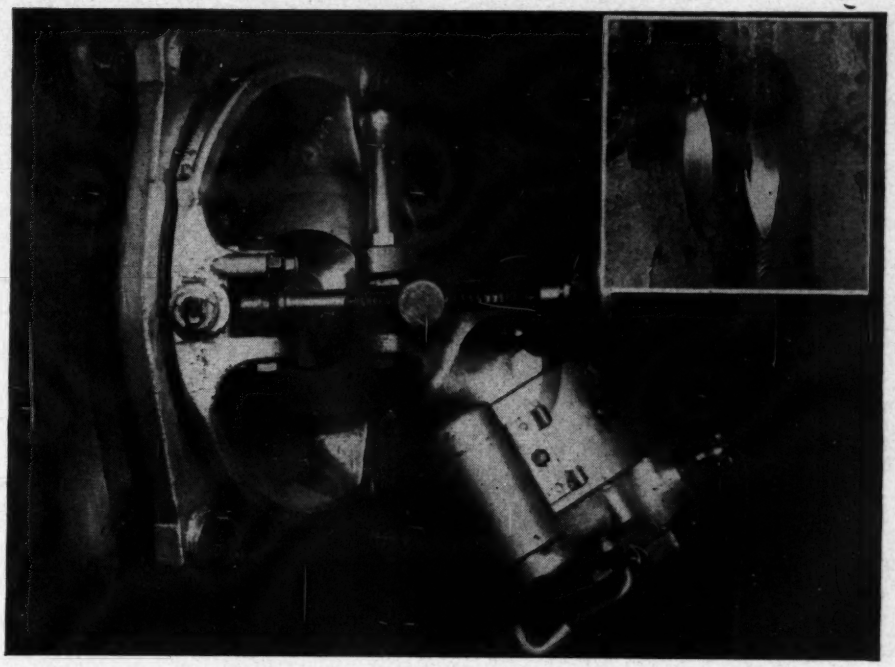


FIG. 11. (Inset) Showing an inspection segment cut from a butt-weld.
FIG. 12. Weld-prober machine for cutting inspection segment out of weld.

Prefabricated Steel

Steel for this holder was purchased from the Carnegie Steel Co. and prefabricated in the Stacey Brothers plant at Cincinnati, Ohio. This prefabrication consisted of cutting, bending, shaping and welding large sub-assemblies, consistent with possibilities of railroad transportation. This enables easy and rapid assembly at the construction site, as well as accurate fit and line-up of the immense structure. As an illustrative example can be given the shop-welded cup and grip assemblies, bottom and curb assemblies with their respective hanging rows. Each one of these groups consists in this case of 22 sub-assemblies, 44 per lift or 220 for the five lifts which were shop fitted to each other and match marked for field assembly. Similar economies were accomplished by shipping to the field, holder panels with verticals assembled and welded to them. In turn, the field made out of these panels other large field group assemblies by welding them on the ground. Fig. 6 shows a large finished panel group being lifted inside of the water tank, where the holders are being assembled.

Sequence of Construction

This welded type of construction lends itself readily to orderly and efficient progression of the work, as will be noted in the following description of the progressive steps in the erection of this holder.

Following the obvious first step of foundation construction, as already described, the construction sequence carried on under the direction of William N. Creasey, field superintendent, was as follows:

1. *Lay the floor plates, or tank bottom:* These plates were laid on a one-inch cushion of oiled sand and spread over the concrete floor slab. All welding was done from above, partially by lap welds and partially by butt welds with underneath backup strip.

2. *Erect the tank shell:* These plates are welded, both inside and out. Fillet welds are used at the juncture of the shell plates and bottom, and butt welds between shell plates. This erection is facilitated by a large crane, pivoted on a center post (which remains a permanent part of the holder structure) and revolving on a circular track laid on the floor plates around the inside edge. This crane, and the commencement of this phase of the construction, are shown in Fig. 7.

Fig. 8 shows the tank section virtually completed; also the center post, and crane, and a portion of the permanent wood framework that is later used to fabricate and support the crown.

3. *Erect intermediate lifts or sections:* This is done by beginning with the outer or largest lift and ending up with the inner or smallest. Each section is completely assembled and welded on the inner side which is accessible from the scaffolding. Butt welds are used in curb and channel sections also in the bottom and top hanging rows. The laps between the panels and hanging rows are welded with light fillets for tightness only. (The outside is welded later for strength and additional tightness.) The method by gradually inflating the holders and then welding them outside is patented by Stacey Brothers.

4. *Erect vertical portion of inner lift or section:* This is erected in the same manner as the intermediate sections.

5. *Erect two sections of guide frame.*

6. *Remove erection crane.*

7. *Erect remainder of permanent wooden structure,* used to fabricate crown of inner lift or section, and support it when deflated.

8. *Fabricate crown or top of inner section:* This is done by using the wooden framework as support, starting from the edge and working inward. The crown sheets are welded both inside and out, using fillet welded lap joints.

Fig. 9 shows the wooded supporting framework completed and the outer rows of the crown sheets in place.

Fig 10 shows a close-up view of the completed tank and the two outer intermediate sections or lifts.

9. *Erect balance guide frame* and install carriages.

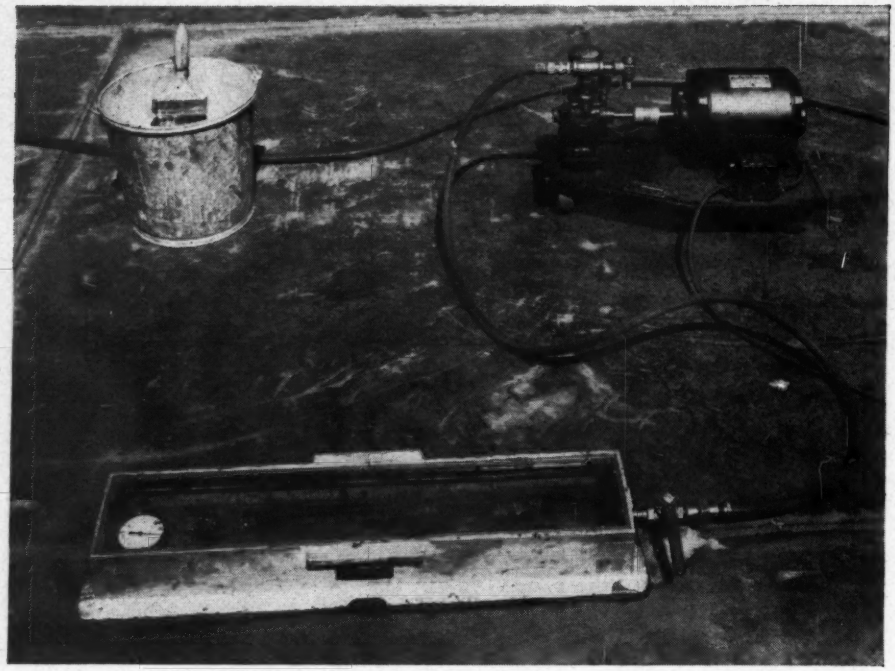


FIG. 13. Vacuum seam tester in use.

10. *Fill tank with water.*

11. *Inflate* to slowly raise lifts.

12. *Weld outside of each lift* as it rises from the water.

Inspection and Weld Testing

The supervision of construction, welding and qualification of welders was performed by the Los Angeles district offices of the nationally known firm of Robert W. Hunt Co.

The welding construction of the holder was in accordance with the American Welding Society Code, using electrodes meeting ASTM Specification A-233. All welders are tested to requirements before performing any work, and their performance periodically checked by examination and tests of welds.

Welds were tested by the Weld-Prober, whereby sections can be cut from the weld and immediately adjacent metal and examined for quality of weld metal, penetration, etc. Fig. 11 shows an inspection segment cut from a butt weld. Fig. 12 is the weld-prober machine which cut out the inspection segment. These segments are etched for examination.

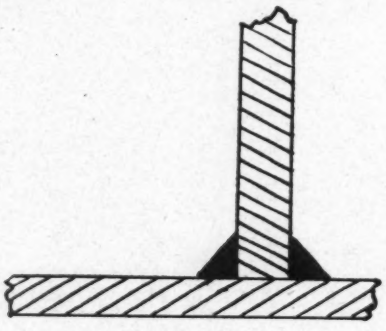


FIG. 14. Diagram showing welded joint of the shell to the bottom of the holder.

To insure against leaks in the tank bottom, prior to filling with water, the American Vacuum Seam Tester, developed by American Pipe and Steel Corp. of Alhambra, Calif., was used.

This device consists essentially of a metal inspection box with rubber-gasketed bottom edge and heavy plate glass top. The seam to be inspected is brushed with a soapy solution, and the box placed over it and evacuated. Even minute leaks in the portion of the seam covered by the inspection box will cause large clusters of bubbles clearly visible through the glass top. Fig. 13 shows this apparatus in use.

Advantages of Welding Over Riveting

1. *Weight Reduction*

The influence of weight reduction is cumulative, because it consists in the value of steel saved, the fabrication cost and the freight saving. For instance a large portion of connection clips necessary for riveting of verticals to shell of lifts are eliminated. In general construction work close weight comparisons had been made for this type of construction. The elimination of clips amounts to 5% to 15% of the total structure. Considering the fabrication cost of about 4c per lb., steel cost 3c per lb. and freight on long distance about 1c, a worth while saving is made of approximately 8c per lb. of material saved. Considerable freight reduction is made by shipment of the bottom and crown plates directly from the mill to the site. A very essential freight saving is evident by the reduction of field equipment. The compressor capacity is reduced at least by 75%. There are no bull riveters, no rivet heating equipment and no rivet guns required.

By referring to Fig. 7A taken at a riveted holder site and comparing same with similar photographs taken at Long Beach, it is interesting to note that in the former case two trammels were required for a riveted job, while only one trammel is required in Fig. 7. In this case, a total freight saving on the tools amounts to about $3200, because in the riveted holder 323,000 lbs. of tools were required, while on a welded job only 257,000 lbs. were necessary.

An essential advantage of the entirely welded shell is the elimination of the heavy curb angles, which were only necessary to enable joining of the shell plates to the bottom plates by means of riveting, also the elimination of butt straps on all butt joints. The welded joint of the shell to the bottom is shown in Fig. 14.

2. *Shop Fabrication*

In the riveting many thousands of holes had to be punched in the bottom and crown plates and also in the tank shell plates and the necessary buttstraps as well as in every component part for all lifts requiring rivet holes at a very close pitch. This large number of plates with many rivet holes is replaced by a relatively small number of panels 25 ft. to 30 ft. long and about 5 ft. wide with a few fit-up holes. These are the only members between the top and bottom hanging rows.

It is interesting to compare the uniformity of welded and riveted cups or grips. The former are much more uniform in contour. This is essential as lifts could hang up on each other, while they are being inflated or deflated. Another advantage of shop fabrication is the testing for leaks of shop assemblies by means of kerosene.

3. *Manhours*

Advantage of laying tank bottom directly on sand cushion and testing seams as work goes along. This method of construction is far easier, quicker and requires far less man hours, compared to when the bottom had to be riveted on horses, the first ring attached to same and the bottom tested with water, then lowered with an

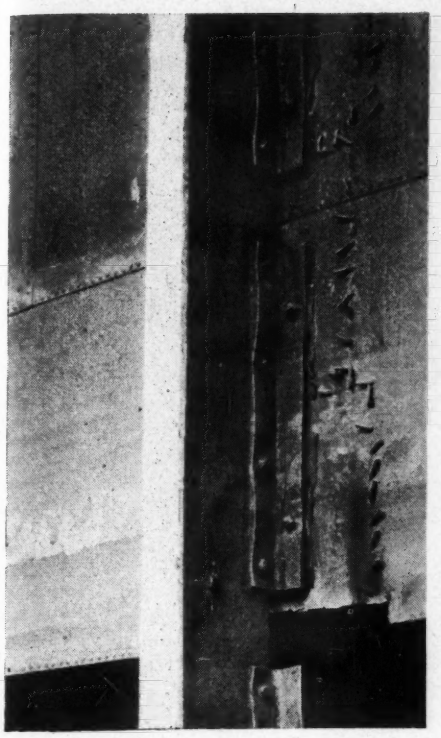


FIG. 15. Riveted stiffeners on inner lift showing exposure to corrosion.

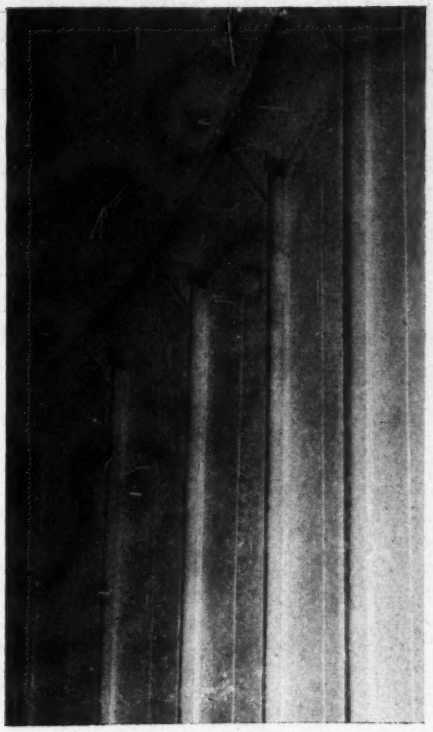


FIG. 16. Welded stiffeners on inner lift of Long Beach holder.

elaborate setup with lowering screws. We know also that most of these riveted bottoms leaked after while, which contributed to corrosion.

A correct comparison would be difficult to make today between riveting and welding on base of manhours, because we are trying to compare time of two different methods, one of which, namely the riveting, was in general practice about 20 years ago, while welding is preferred now.

The sealing against leaks was accomplished by hand caulking in riveted work. It is doubtful, whether a sufficient number of men could be found today to do dependable hand caulking. This is the condition of the present era. A riveted job attempted now would take longer than it took between 1920 and 1940 and very likely would require more time than a welded job and would not be as dependable.

4. *Less Tendency or Opportunity for Corrosion*

In riveted construction of the tank and lifts, with the sheets either butted or lapped, the rivet heads themselves, and the cracks (even though minute) where the rivet hands grip the plates, and the sharp edges, corners and cracks where the plates meet or lap, encourage the penetration and accumulation of water and dirt, with the formation of corrosion and corrosion products which promote progressive deterioration, and are difficult if not impossible to remove prior to repainting. On the other hand, the all-welded construction with smooth weld metal surfaces instead of cracks and crevices, prevents the accumulation of corrosive agencies and makes general cleaning and painting easy and effective.

Similarly, the construction angles, sheet stiffeners, braces, framework, stairways, etc., present innumerable cracks and crevices and catch points for the deposition of corrosive substances and the accumulation and progressive development of corrosion, and it is practically impossible to protect such vulnerable points by paint, or clean them after corrosion has developed. With welded construction as already described, whereby all metal juncture edges are welded along their entire length to positively exclude water and corrosive media, and all other joints are smooth metal surface transitions, potential corrosion is eliminated and general cleaning and painting facilitated.

Figs. 15 and 16, showing internal stiffeners in riveted and welded construction, respectively, quite clearly show this difference between the two types of construction.

Figs. 17 and 18, showing standard supports, riveted and welded respectively also show this same difference.

5. *Expectant Life and Maintenance of Welded Gasholders*

Compared to riveted holders, all the surfaces of welded holders have relatively few protrusions and therefore can be more easily cleaned and painted, with proportionate reduction in cost of maintenance since sources of accelerated corrosion have been eliminated, we can justly expect a longer life of the welded structures.

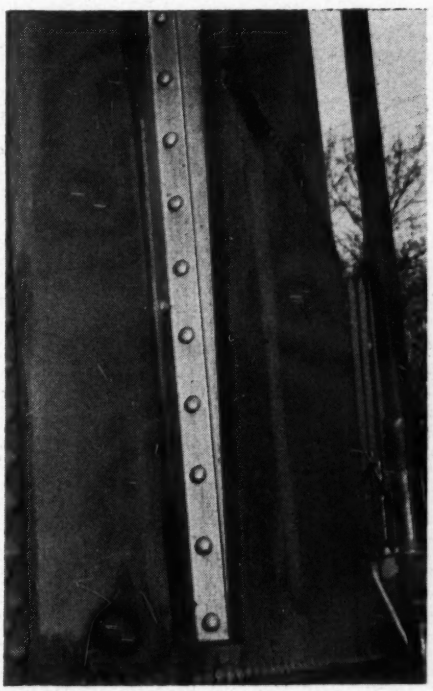


FIG. 17. Development of corrosion between standard supports attached flush to steel tank shell.

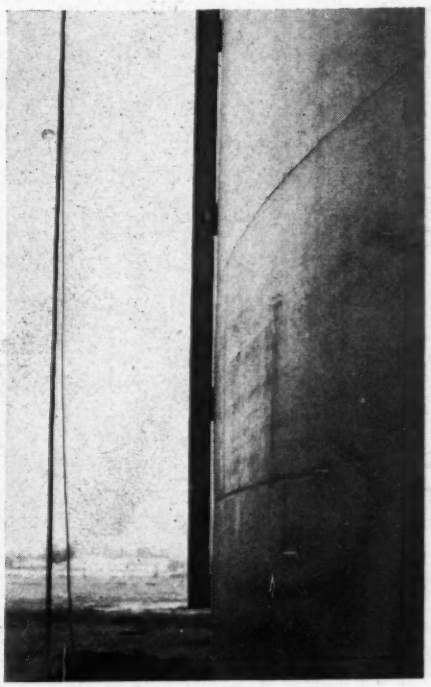


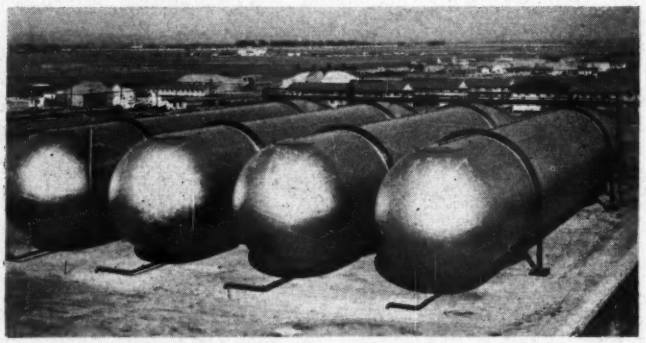
FIG. 18. Standard supports on Long Beach holder showing how welded construction minimizes opportunity for corrosion.

SOUTHWEST WELDING & MANUFACTURING COMPANY field erected four High Pressure GAS HOLDERS, 34′ in diameter x 205′ overall in length, totaling 2,000,000 cubic foot capacity, under subcontract to Bethlehem Steel Company, for the City of Long Beach, California.

These huge GAS HOLDERS were completely fabricated from A-212 Grade B Firebox Plate, and constructed to withstand an operating pressure of 55 pounds PSI. To insure quality in field-welding, all seams were Magnafluxed, and upon completion, GAS HOLDERS were subjected to a 60.5 pound PSI air test. Approximately 1,500 tons of steel were required in the erection of the four GAS HOLDERS.

SOUTHWEST'S efficient engineering personnel, supervision and field crews are your assurance of receiving good workmanship on any type of steel construction, including pressure holders, penstocks, syphons, caissons, field storage tanks of any size, capacity or location.

Consult us on your future requirements



Southwest Welding & Manufacturing Co.

Alhambra, California

3. Design of All-Welded High Pressure Tanks

FOUR horizontal cylindrical pressure gas holders for the Gas Department of the City of Long Beach, Calif., were constructed under contract with the Bethlehem Pacific Coast Steel Corp.

These holders have a volume of 175,000 cu. ft. each. The gas will be compressed in the holders to a pressure of 50 psi gauge pressure and this can be released into the gas mains until the pressure is reduced to 5 psi. This will therefore permit the storage of 500,000 cu. ft. of useable gas per container, or a total of 2 MMcf.

General Specifications

Each holder consists of a horizontal cylinder 34 ft. 0 in. outside diameter, with a cylindrical barrel 171 ft. 8 in. long and two hemispherical heads, making a total length of about 205 ft. 8 in. Fig 1 shows construction details.

The cylindrical shell is made up of steel plates 0.81 in. thick (about 13/16 in.), and the hemispherical heads of plates 0.41 in. thick, (about 13/32 in.).

Each cylinder is held to shape by means of two external ring girders placed 110 ft 0 in. apart. Each ring girder is supported by two columns which provide the support for the holders.

These holders represent about the largest structures of this type that have been built and the first of this size to be of completely welded construction.

The design conforms to the requirements of the Unfired Pressure Vessels Code prepared by the American Petroleum Institute and the American Society of Mechanical Engineers. The steel selected for the shell and head plating conforms to A.S.T.M. Specification A-212, Grade B, Firebox quality. This steel is high tensile strength carbon-silicon steel plates for boiler and other pressure vessels. The steel has a minimum ultimate tensile strength of 70,000 psi. The allowable working unit stress permitted by the above mentioned code is 17,500 psi and the allowable welded joint efficiency is 80%. This provides against imperfect welds up to 20%, yet it is very probable that all of the welded joints will have close to the full strength of the plates. This 80% factor reduces the working unit stress to 14,000 psi. This value is just one-fifth the minimum strength of the plate material, which provides a good margin of safety in the design.

Each holder is protected against overloading by two 4 in. diameter safety valves that will open when the pressure exceeds 55 psi.

The structural supporting members were designed to conform to the specifications of the American Institute of Steel Construction and to the Building Code of the City of Long Beach.

The structures were designed for a seasonal temperature variation of 100° F., which will cause a change in length of about 1½ in.; and because of their large diameter, for a temperature differential of 50° F. between top and bottom of the shell or between opposite sides. This latter condition will deflect the cylinder out of a straight line. They were also designed to resist a seismic impact of 20% of gravity applied horizontally in any direction, or vertically.

Supporting Ring Girder Design

The design of the supporting ring girder presented a complex mathematical problem. These girders must support the containers under all conditions of loading, including temperature differentials, wind and seismic loading and the weight of the structure.

The columns and connections must provide for changes in length due to temperature changes, warping of the cylinders due to temperature differentials on opposite sides of the cylinder and to resist wind and seismic load-

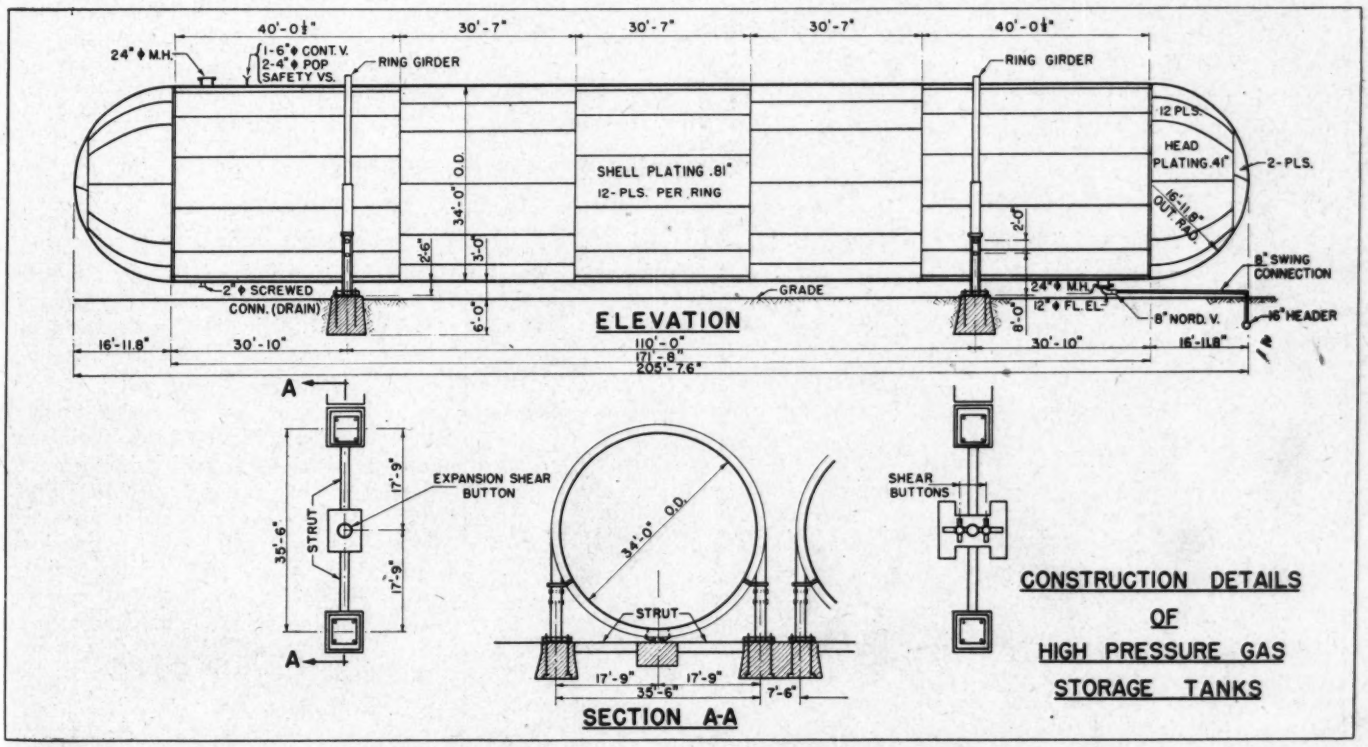


FIG. 1. Construction details of high pressure storage tanks.

ing and the weight of the structure. The connections between the ring girders and the columns consist of linkage attached with pins which provide the necessary flexibility and strength. There is a safety provision in the connection which provides that in the case of abnormal end motion due to seismic impact, a pedestal on the ring girder will engage the top of the column and support the holders directly on the columns.

Design of Bottom

The bottom of the holder shell adjacent to one ring girder is attached to a double support in the foundation called the fixed shear button. Each part of the double attachment consists of one pipe cylinder attached to the holder shell which slides vertically inside another pipe cylinder attached to the foundation. This permits freedom for the holder shell to expand under pressure. This attachment resists wind, temperature and seismic loading.

Another shear button is placed on the bottom of the opposite ring girder. This sliding shear button connection will permit longitudinal motion caused by temperature changes, but it will resist side wind and seismic loading.

The cylinder is composed of 5 rings of plates, each ring having 12 plates to the circle. Each plate is about 107 in. wide and from 30 to 40 ft. long. Each two shell plates were automatically welded together on the longitudinal seams by the submerged arc method in the shop and were hauled to the site on large trucks requiring special police escort. The six remaining longitudinal seams in each ring were manually welded at the site.

Each hemispherical head was formed of 12 segmental plates and 2 cap plates. All were pressed in dies to spherical shape in the shop. These head plates were completely assembled and welded into hemispheres at the site before attaching to the cylinders.

All welded joints in the shell and hemispherical ends were double groove, double welded butt.

All manually applied welds in the holder plating were peened after applying each weld pass, except the first and cover passes. The peening was performed when the weld metal was warm to the hand.

TABLE 1. EXCERPT FROM SPECIFICATIONS FOR TESTING HIGH PRESSURE HOLDERS WITH AIR

In accordance with the API—ASME Code. and Specifications No. C-642 prepared by the City of Long Beach, and, after consulting with the Gas Dept. of the City of Long Beach and the R. W. Hunt & Co., the procedure shall be as given below.

(A)—*SOAP AND WATER TEST.*

Each tank is to be put under about 5 psi air pressure and all pressure and all welded seams tested with soap and water. All leaks were repaired as directed by the R. W. Hunt & Co.

(B)—*LIME WASH TEST.*

The following areas are to be coated with lime wash and tested in accordance with instructions given in the API-ASME Code and Specification C-642.

1—(a) *Seams Between Shell and Heads.* A band 6 in. wide on each side of the circumferential seam, extended about 6 ft. on each side of the top center line, is to be coated.

(b) A second area, about 4 ft. square, is to be coated. This area shall be near the top center line of the tank and extending about two (2) ft. on to the head so as to cover a radial seam.

2—*Intermediate Circumferential Seams.* An area 4 ft. square to be coated across each seam at the bottom of tank near center line.

3—*Longitudinal Seams.* Coat an area 4 ft. square across seam near bottom center of tank.

4—*Ring Girders.*

(a) At top of tank, apply a band, about 5 ft. long, to the cover plate and web plates and extending each way from the face of the web plates across the attachment reinforcing plate and about one (1) foot beyond. This covers in plan an area about 4 ft. 8 in. x 5 ft. 0 in.

(b) Apply coating to ring girder, as given above, with center of areas 7 ft. 6 in. up from horizontal center line, measured on outside of shell.

(c) Apply coating to ring girder, as given above, with center of areas 11 ft 0 in. down from horizontal center line, measured on outside of shell.

5—*Manholes.* Apply coating to shell plate adjacent to manhole reinforcing plates. Band to be three (3) ft. wide and extending around reinforcing plate.

6—Any other area designated by R. W. Hunt & Co. is to be coated.

The procedure for welding each type of joint was qualified to prove its suitability by means of the procedure established for this purpose by the American Welding Society.

All welding operators were tested to prove their welding ability by means of the procedure established for this purpose by the American Welding Society.

Testing of Welds

All welded joints in the shell and head plating were tested both inside and outside with Magnaflux. This testing is not required by the code under which the vessels are being constructed, but was adopted by the contractor as an extra precaution to prove the thoroughness of the welded joints. This testing process consists of magnetizing a portion of the plating straddling a portion of the welded joint. While magnetized, a magnetic powder is sprinkled over the joint. If there is a crack or other defect in the weld it will cause a break in the magnetic field which causes the magnetic powder to build up as a ridge over the spot and thus make it evident. This process was repeated so as to test every inch of the holder seams. Any defects disclosed were chiseled out to sound metal and rewelded and then retested. After completion of each holder, all welded seams were further tested against leakage by applying an internal air pressure of 5 psi and painting outside seams with soap suds. Any leaks were disclosed by air bubbles. Lime wash was then applied to certain seams and more highly stressed points on the shell and ring girders. After the lime wash had dried to a brittle coating, the internal pressure was raised by increments to 110% of the working pressure, namely, to 60.5 psi. The places over which the lime wash was applied were watched for flaking of the coating, which might indicate overstressing of the materials. An excerpt from the specifications for testing the holders with air is given in Table 1.

When the tests were satisfactorily completed, the holders were purged to remove air by the introduction of carbon dioxide gas which in turn was forced out by filling with natural gas. This method of purging follows the established procedure of the American Gas Association and eliminates the risk of having an explosive mixture of air and gas in the holders at any time. Upon completion of this operation, the holders are ready for service.

The holders were designed under the direction of H. O. Hill, assistant chief engineer, Bethlehem Steel Co., Bethlehem, Pa.

FIG. 1. View of completed tanks.

4. Erection Details of High Pressure Tanks

As part of the program of expansion the Gas Department of the City of Long Beach erected four 500,000 cu. ft. 50 psi gas holders adjacent to their butane standby plant on Spring Street.

Specifications with respect to capacity, pressure and location were prepared by the department and bids for a turn key job of design and construction were called for.

The contract was awarded to the Bethlehem Steel Co. who was low bidder and who had submitted a design wherein the total tonnage and cost was materially reduced by the use of high tensile steel for the tank shells.

Prior to acceptance of the proposal, the department engaged R. R. Martel, professor of structural engineering at California Institute of Technology, for a complete study of the entire structure including foundations with particular reference to security against seismic impact.

His analysis covered the following items:

1. Moments and thrusts in the ring girders from
   (a) dead load
   (b) wind and seismic forces.
2. Moments due to constriction of ring girders
   (a) in shell at the edge of the inner girder flange
   (b) in inner flange at the girder webs.
3. Stresses in shear buttons and shell from
   (a) longitudinal lateral forces
   (b) transverse lateral forces.
4. Foundation pressures from
   (a) dead load
   (b) wind and seismic forces.

The contractor's engineers cooperated with the consultant and made the changes in design necessary to take care of the local conditions whereupon they were awarded the contract.

Soil bearing investigations were conducted by Frederick J. Converse, consulting engineer, Pasadena, Calif.

The tanks are designed in accordance with the API-ASME code for Unfired Pressure Vessels. The supporting structure was designed in accordance with the AISC code.

The work of clearing the site and erecting the foundations was sublet to Charles W. Pettifer, Long Beach contractor, and the work of tank erection was sublet to Southwest Welding & Manufacturing Co. of Alhambra, Calif.

A number of interesting and novel features of erection were devised by the contractors due to the size and weight of the plates handled which are more fully described here.

The four completed tanks are shown in Fig. 1.

Erection of 34 ft. Diameter Horizontal Gas Holders

In general, the plan for erection included placing of support cradles to receive the lower shell plates, the employment of segmental field spiders for supporting the central and upper portions of the shell plates as they were erected, the advance assembly of each separate hemispherical head, and then the attachment of the hemispherical heads to the ends of the cylindrical shell, the removal of the internal erection accessories, and finally the placement of the holders on the permanent steel supports and removal of the temporary cradles.

The curved cradles or saddles on which the lower shell plates were placed were made of heavy timber, and rested on wooden sleepers, because of the inability to obtain WPB allocation of steel for this purpose at the time the project was started, which was before the end of the war. After making due allowance for settling and shrinkage, these wooden cradles proved satisfactory. The cradles were placed 24 to 30 ft. apart, transverse to the axis of the holders, and vertical adjustment of the position of the holder was accomplished by means of compound wedges driven between the top of the cradle and the underside of the adjacent plate being supported. These wedges occupied from 4 to 6 inches, and their removal, as will later be described in detail, permitted lowering of the holder onto the permanent supports before removal of the cradles.

The shell plates were formed, and pre-assembled at the fabricating plant in as large sections as could be transported to the site, to minimize the amount of field welding. The largest shell section consisted of two 9 ft. x 40 ft. plates welded together, making a section 18 ft. curved-width by 40 ft. long, weighing 12 tons. These sections comprised the end courses of each holder, the intermediate courses being 30 ft., 7 in. long, and each erection segment of the intermediate courses

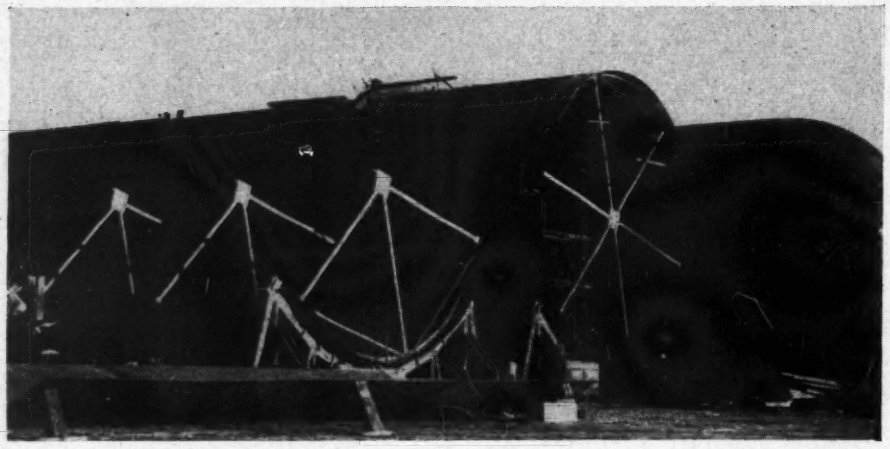


FIG. 2. Holder No. 2 with first course completely assembled; second course, 3 plates assembled; third course, 1 plate assembled.

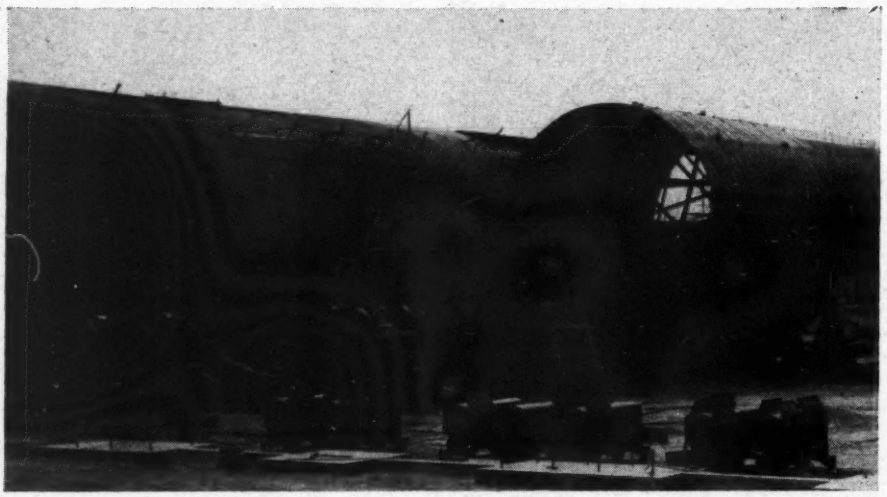


FIG. 3. Six-legged internal spiders with supporting rim; also shell of holder No. 2 completely assembled, and two plates erected in shell of holder No. 3.

consisted of two plates 9 ft. x 30 ft., 7 in. long, making an erection piece weighing 9 tons. The heaviest lift during erection was even heavier than the shell plates just described—each hemispherical head when completely assembled before lifting and attaching to the shell, weighed 15 tons. Accordingly, large equipment was necessary to lift such heavy pieces into final position. Two Crawler Cranes were provided, each with a 5-ton jib boom for light lifting or for employment of a stabilizing line to aid in holding large sections in position during placing.

Sequence of Erection

The sequence of erection of the shell plating was a compromise between completion of individual shell courses or "rings" one by one, and the alternate proposed method of laying all the lower plates along the wooden cradles for the entire length of the shell, similar to the laying of the keel of a ship. The sequence actually used consisted of commencement of erection of one ring, the beginning of the second ring shortly thereafter, and the subsequent beginning of the third, fourth, and fifth rings at about the time the first ring was completed and the second ring neared completion. This resulted in what might be termed a "stepped" assembly, when viewed broadside. (See Fig. 2.) The six-legged internal spiders were each provided with a ring, such that the spider and ring together formed a giant wheel, the outside diameter of which was slightly smaller than the inside diameter of the holder shell. The rim of the "wheel" was divided into six segments, each of which was attached to its corresponding segment of the shell plating before placing that segment of shell plating. (See Fig. 3.)

Access was had to the outside of the field joints to be welded by means of steel scaffold brackets attached to the shell plating, with scaffold planking and safety rails added. Access to the welded joints to be made inside of the holder was accomplished by a combination of similar scaffold brackets and scaffolding, plus the use of a rolling "Safeway" steel scaffold which was arranged to traverse the entire length of each holder. This Safeway scaffold inside was particularly useful in traversing all of the welded seams for inspection and Magnafluxing, which will be described elsewhere. The inside rolling scaffold was left within the holder even after the last head was in place, in order to complete the inside welding and "Magnafluxing" of the final head seam; the Safeway scaffold was then dismantled and removed through an access opening, which was then finally closed to complete the holder.

Construction of Head

Each hemispherical head consisted of 12 segmental "orange peel" sections, plus a circular cap plate made of two separate plates pre-assembled. Each hemispherical head was assembled in the position of an inverted teacup, the 34 ft. diameter being maintained by means of a jig built of steel in the form of a 12-sided polygon with the 34 ft. diameter inscribed. This made it possible to wedge or jack the outside circumference of the hemispherical head into a truly circular shape, working entirely from the outside of the jig. Within the inverted head, a staging was built to support the small ends of the segments as they were laid in place. (See Fig. 4.) After all 12 segments of each head were assembled, the cap plate was lowered in place to close the opening. Two special lifting lugs were temporarily attached to each head prior to lifting in place, these lugs being located opposite the center of gravity of the head. (See Fig. 5.)

The permanent steel supports for each holder consisted of two external ring girders located approximately at the quarter points along the length, and each ring girder was provided with two pedestal sections to transmit the load of the holder, through a pin-jointed linkage, to the vertical steel columns. Each ring girder consisted of three erection sections. The two lower sections of a ring girder each with its integral pedestal, were applied to the shell at the proper location, joined at the bottom by welding, and then jacked up tightly against the shell by means of the illustrated erection jacks working at the column locations. The third, or closing section, of the ring girder was then placed at the top, completing the ring. This top section of the ring girder was dogged tightly against the shell, along the edges of what might be

termed the reinforcing plate of the girder, and in addition it was occasionally necessary to attach strongbacks to force the girder tightly against the shell before final welding.

It should be mentioned that the smaller accessories, such as manholes and nozzles, were shop-installed on the respective shell sections prior to erection. Careful procedure control in the shop-assembly of these sections containing manholes and nozzles, resulted in practically no distortion of those sections by the attachment.

Permanent Placing

To facilitate the sequence of work in proceeding from one holder to the next one of the four holders being erected under this contract, the procedure was to complete the cylindrical shell, attach the ring girders, and then to support the shell on the permanent columns before attaching the heads. In order to place a completed shell with attached ring girders on the permanent columns, a pair of 100-ton jacks was employed at each of the two columns near one end of a holder, to take the weight of the holder-shell off of the wood cradles so that the wedges could be removed. At this time, the two shear buttons were attached near the bottom of the west ring and girders, to safeguard against lateral shifting. Then the holder was lowered as required to allow the pin-joints of the rocker support to be installed, Fig. 6, and finally the jacks were removed allowing the holder to rest on the permanent supports. (See Fig. 7 for close-up view of the jacking arrangement.)

There were no particular erection problems involved in the placement of the transverse walkway between and across the four holders, together with the vertical caged ladder provided at each end of the entire walkway.

Since all concrete piers were set in advance of the erection of the holders, it is a tribute to the accuracy of the preliminary fabrication, and the uniformity of welding procedure during erection that no difficulty was encountered in fitting the pin-jointed connections, and that all of the pin-jointed connections stood in their predicted alignment upon completion of the final setting of the holder. A further discussion of the welding problems involved in the erection of these holders is given below.

All of the welding was specified to be in strict accordance with the API-ASME Code. All welders were qualified by means of bend tests made at the jobsite and witnessed by the R. W. Hunt Co., inspector. Procedure qualification tests for the welding, and periodic tests as required according to the footage of seams welded, were made in accordance with the Code, and tested by the R. W. Hunt Co.

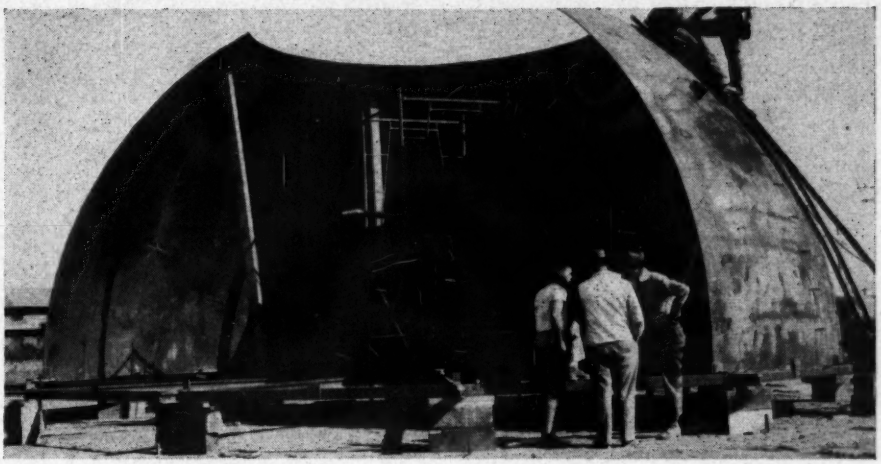


FIG. 4. Method of assembling hemispherical head—east head for holder No. 1.

The steel in both the shells and heads was A-212 Grade B Firebox quality; this is a high tensile steel, requiring pre-heating for successful welding, particularly under adverse weather conditions. Because of the nature of this high tensile steel, not only was pre-heating employed when necessary, but a very carefully controlled back-step sequence of welding was followed. All welding bevels were prepared by the prime contractor during shop fabrication, and all welded joints were double V beveled. Accordingly, nearly 50% of all of the field welding of the pressure joints in the holders was required to be done in the overhead position. Each holder had 7000 lineal feet of welded seams, of which over 3000 ft. were field-welded.

Inasmuch as the holders were designed only for the gas pressure required to be held, they were incapable

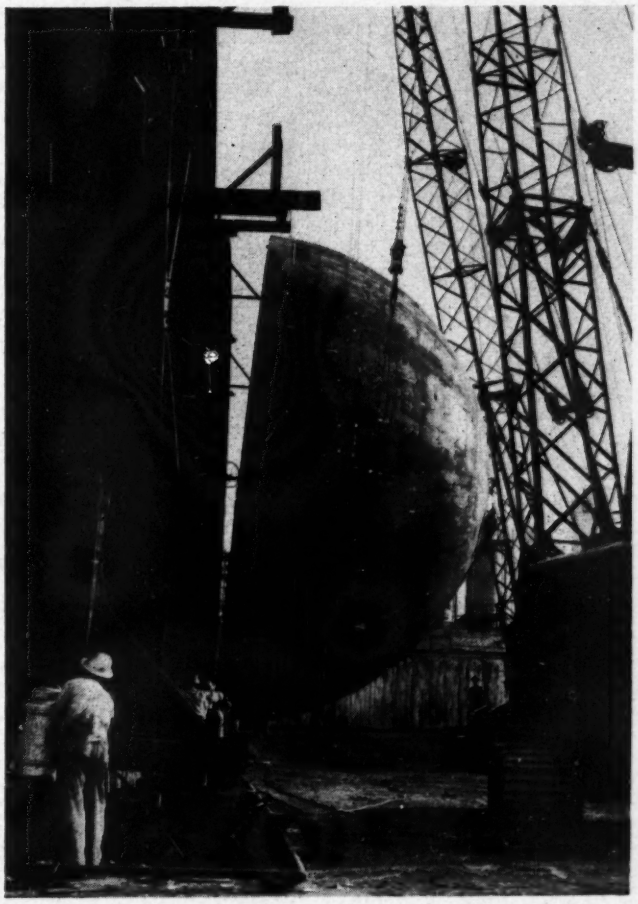


FIG. 5.

Moving of assembled hemispherical head into place by means of crane and temporary lifting lugs. Erecting west head of holder No. 1.

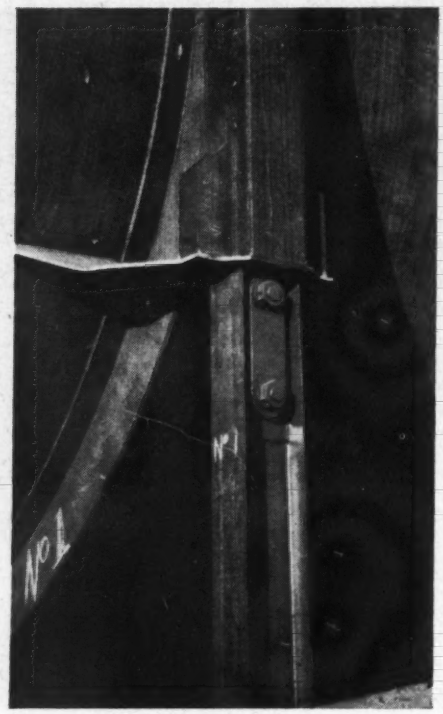


FIG. 6. Girder to column link connection. Southeast column of holder No. 1.

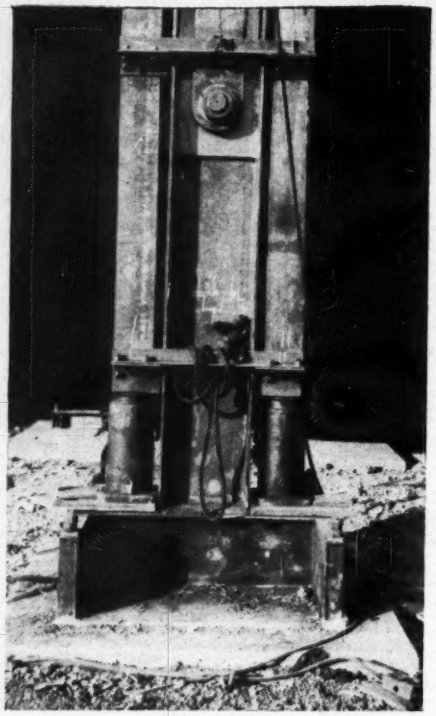


FIG. 7. Jacking arrangement to lower completed shell onto supporting columns

of sustaining the load of water that would be necessary for hydrostatic testing. An air test in accordance with the API-ASME Code, therefore, was specified. This air test requires testing at a pressure of 110% of the design working pressure, with air, under a carefully controlled procedure of gradual increasing of air pressure.

Because of the hazard always present where an air test is made without a prior hydrostatic test, all welded seams were checked for incipient cracks or other defects that might cause failure during air test by the Magnaflux method.

This is a rapid visual inspection by a technique of applying magnetization and ferro-magnetic particles to the areas to be checked. A suitable magnetic field is set up in the welded area. Sudden interruptions to this magnetic field due to cracks, slag inclusion or blow holes invisible to the naked eye crowd some of the magnetic flux outside of the surface of the weld. These so-called leakage fields attract and hold finely divided ferro-magnetic particles. The inspector sees in the accumulation of particles a definite indication of the exact location, as well as the extent and shape of the defects in the weld.

By employment of the Magnaflux method of inspection, a few minor defects were discovered that might otherwise have escaped detection during inspection. Because of the careful procedure control, and because the few defects that were discovered by Magnaflux were promptly and carefully repaired and re-Magnafluxed, the holders are free of leaks in the welded joints.

In applying the air test mentioned above, the air pressure was first raised to 6 psi gauge, at which time all welded joints were soap-and-water tested for possible leakage. After a complete survey of the welded joints, the air pressure within the holder was raised to 27.5 psi gage, at which time all critical areas as to stress, which had previously been coated with brittle whitewash, were carefully examined for signs of distress. The air pressure was then gradually increased, in approximately 6 psi increments, and after each increase of pressure the critical areas were re-examined. The final air pressure reached before acceptance of the air test was 60.5 psi. An idea of the time required to build up the required air pressure within each holder can be had from considering the fact that each holder held 890,000 cu. ft. of "free" air in its 175,000 cu. ft. of actual volume, at the final test pressure of 60.5 psi.

After completion of the air test, each holder was purged in accordance with A.G.A. requirements, using equipment provided by special arrangement with the Southern Counties Gas Company of California, Los Angeles.

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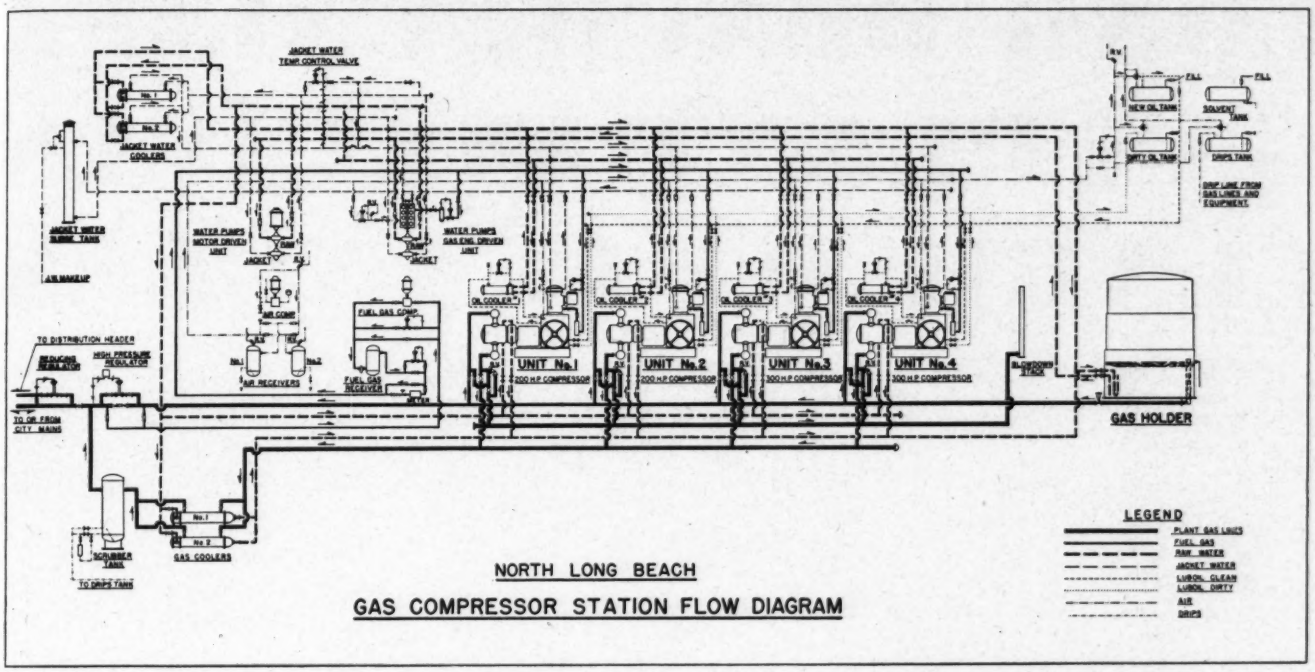


NORTH LONG BEACH

GAS COMPRESSOR STATION FLOW DIAGRAM

FIG. 1. Flow diagram of 1000-hp. gas compressor plant.

5. 1000-HP Gas Compressor Station

BECAUSE of the location of the new all-welded low pressure holder in an outlying section of the city, it was necessary for the Municipal Gas Department to construct a new $210,000 compressor plant. This station, consisting of four Clark engines, was designed to boost gas from the low pressure holders into the system at the rate of 500,000 cu. ft. per hour.

In order to provide the greatest amount of flexibility for the variation of load requirements, it was decided to install several small units rather than one large unit for the maximum capacity. The installation consists of two 200 and two 300 hp. compressors. By various combinations of the above four compressors, capacities of from a minimum of 2 MMcf to the maximum of more than 10 MMcf per day against a line pressure of 50 psi gauge may be obtained in steps of approximately 1 MMcf each. The minimum and maximum capacities are automatically increased as the main line pressure drops by an increased demand until at 30 psi gauge pressure in the discharge line, the total plant capacity is in excess of 13 MMcf. Thus a wide variation may be had under all load conditions. Fig. 1 shows the flow diagram of plant.

The compressor units are all Clark right angle Type RA-two cycle gas engines with 14 in. x 14 in. vertical power cylinders. The gas cylinders are 19 in. x 14 in. and are provided with unloaders for operation between 30 and 50 psi discharge pressures. Each engine is provided with low oil pressure, high water temperature and overspeed safety devices, any one of which will automatically shut off the engine before damage to the plant can occur. Some of the engine accessories are Vortox air filters and Fluor air cooled mufflers. The compressor units are equipped with individual pumps for full force feed lubrication. The oil pumps also circulate the crankcase oil through the filters and coolers. Oil cooling is accomplished by shell and tube exchangers.

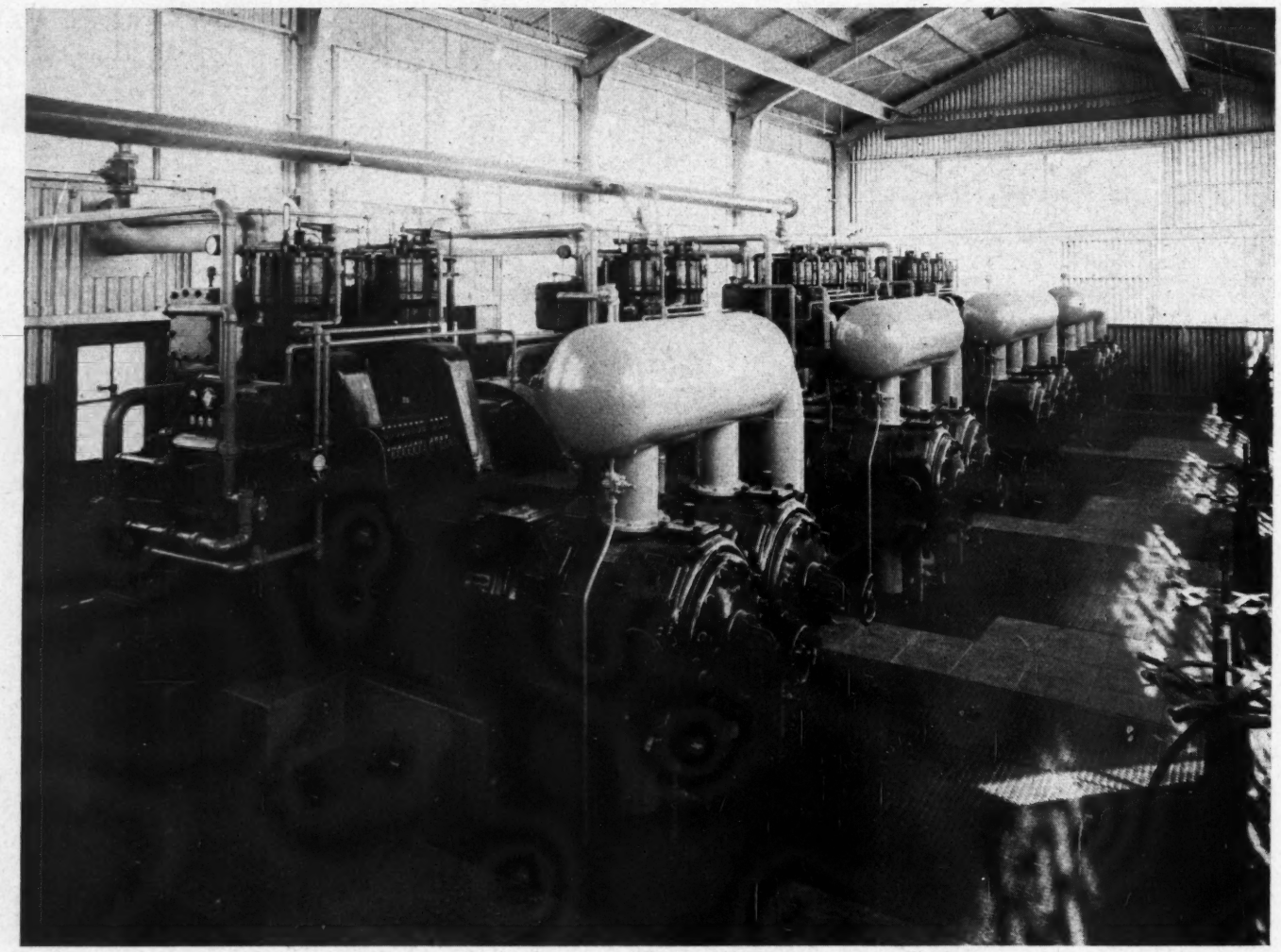
Dehydration Plant

The gas delivered to the plant is substantially free of moisture, having been previously processed through a diethylene glycol dehydration unit operated jointly by the Wilmington Gasoline Co. and the city. (See Page 60.) Therefore no scrubbers or moisture traps in the plant intake line were considered necessary. The discharge gas from the compressors is cooled by two Braun shell and tube exchangers to a maximum of 80° F and passed through a baffled drip tank to remove any moisture accumulated by compression and cooling before going to the gas main.

Fuel gas for the compressors and engine driven auxiliaries may be taken from either the low or the high side of the plant gas line. The two-cycle gas engines operate on 16 to 18 lb. pressure gas. To provide fuel gas at that pressure during periods when the line pressure is too low, a motor driven rotary gas blower of 170 cu. ft. capacity at 22 lb. discharge pressure is provided for supplying gas to the engines. This blower is automatically stopped by a pressure switch when the main line pressure reaches 20 lb. and at the same time an automatic control valve bypasses the blower to connect the fuel system with the main gas line. A 3 ft. x 8 ft. receiver provides ample reservoir capacity. Fuel to the auxiliary units is taken from the same system through pressure reducing regulators.

The engine jacket water cooling is through a closed system. Cooling is accomplished through two Braun shell and tube exchangers using raw water through the tubes for the cooling. The makeup water is introduced into a surge tank where the hot water from the engine jackets is returned to bleed off air and vapors. The hot water from the tank is pumped through the coolers to the cold jacket water header which feeds the power cylinder jackets. An automatic temperature controller bypasses the coolers when the jacket

LONG BEACH, CALIF., GAS PLANT INSTALLS CLARK 2 CYCLE ANGLES



1000 BHP of Clark Right Angles in the Long Beach, Calif. Gas Plant

Four Clark Angle Compressors totalling 1000 BHP, supply the pressure in the Long Beach, Calif. Gas Plant—2 of 200 BHP and 2 of 300 BHP respectively.

These four compressors handle a volume of 13,500,000 Cu. Ft. per day at 30 lbs. discharge pressure.

The flexibility of the Clark Compressors due to devices which permit a wide range of pressures, enables the installation to meet almost any anticipated requirements.

CLARK

CLARK BROS. CO., INC.

OLEAN, N. Y.

●

One of the Dresser Industries

water temperature drops below the point recommended by the engine manufacturer.

The jacket water pump and the raw water pump are mounted in tandem. Both pumps are centrifugal and driven by one motor. A similar unit driven by a Waukeshaw gas engine is installed as a standby.

The raw water used for cooling is the seal water stored in the gas holder, and eliminates the need for a cooling tower. Raw water is circulated through the gas coolers, jacket water coolers, oil coolers and compressor jackets. The hourly rise in temperature of the quantity of water stored in the holder is negligible, and since this station will be operated intermittently only, there will be ample time for the accumulated heat to dissipate during the day's off periods.

Air Starting System

The air starting system consists of a Worthington two stage air cooled motor driven 250 psi discharge compressor and two 3 ft. x 8 ft. vertical receivers. The receivers are manifolded so that one can be used for starting while the other is being brought up to pressure. Air at lower pressure is taken from this system through a reducing regulator for starting the Waukeshaw gas engine pump driver. The usual electric starter, battery and generator —usually a source of trouble in stationary engine operation—is replaced with an air motor such as is used for tube cleaning and provides a very satisfactory motor starter.

Two gauge boards are provided. The one containing the indicating gauges and instruments is located in the main part of the compressor building where the operators have an unobstructed view of all the instruments. Another gauge board on which are mounted the recording and control instruments is located in the operator's office.

The main compressor building is a structural steel rigid frame type of structure 26 ft. wide by 97 ft. long by 17 ft. high. A travelling crane with a 3-ton hoist capable of reaching any part of the building is provided for servicing the equipment in the compressor building. Attached to the west end of this building is a 14 ft. by 26 ft. office building. This portion of the building contains also a shower, lavatory, locker room, and a space for storage of miscellaneous parts. The entire building is covered with corrugated transite, including the roof. Steel doors and window sashes are used throughout. Ventilation is provided through Robertson roof ventilators.

A garage building, 18 ft. x 30 ft., also of steel and transite covering, is provided for the operating personnel. A 24 ft. x 30 ft. section, which is part of the garage structure, serves as a storehouse for machine parts and has sufficient space to accommodate service trucks.

After exhaustive tests of the soil conditions prevailing in this area, it was found necessary to support all foundations for the building, machinery and equipment on piles. A total of 44 reinforced concrete piles were driven in this area, exclusive of the piles under the gas holder.

The entire plant is designed along the most modern lines for safety, ease of operation, maintenance and general appearance. The compressor building floor is elevated above the ground level sufficiently to permit the piping from the building trenches to the outside, to be laid above the ground. All the pipe trenches in the building are of concrete covered over with ¼ in. of checkered floor plate set in recesses in the trench walls and amply supported at intermediate points to withstand the loading required by the Los Angeles County Building Code.

The floors are reinforced concrete finished with Lithochrome color hardener of a dark red tile color.

Piping

All piping except the drain lines are either overhead or supported on concrete piers above grade. Adequate exterior walkways of steel and subway grating with handrails are provided at all doorways, platforms and line crossings. Fig. 2 shows the completed plant.

The preliminary design and specifications for the plant were prepared by the Mel-Mar Co. of Los Angeles under the direct supervision of Guy T. Martin. Mel-Mar Co. was also commissioned by the City of Long Beach to supervise the construction of the plant in collaboration with the Municipal Gas Department's engineering and operating staff.

Personnel involved in the construction work included Samuel L. Spencer, superintendent of production, Municipal Gas Dept., Long Beach; Martin A. Nishkian, chief engineer, Oil Field Construction Co. of Long Beach, the contracting firm; and Art Nelson, superintendent for the contractor.

FIG. 2. View of completed plant.

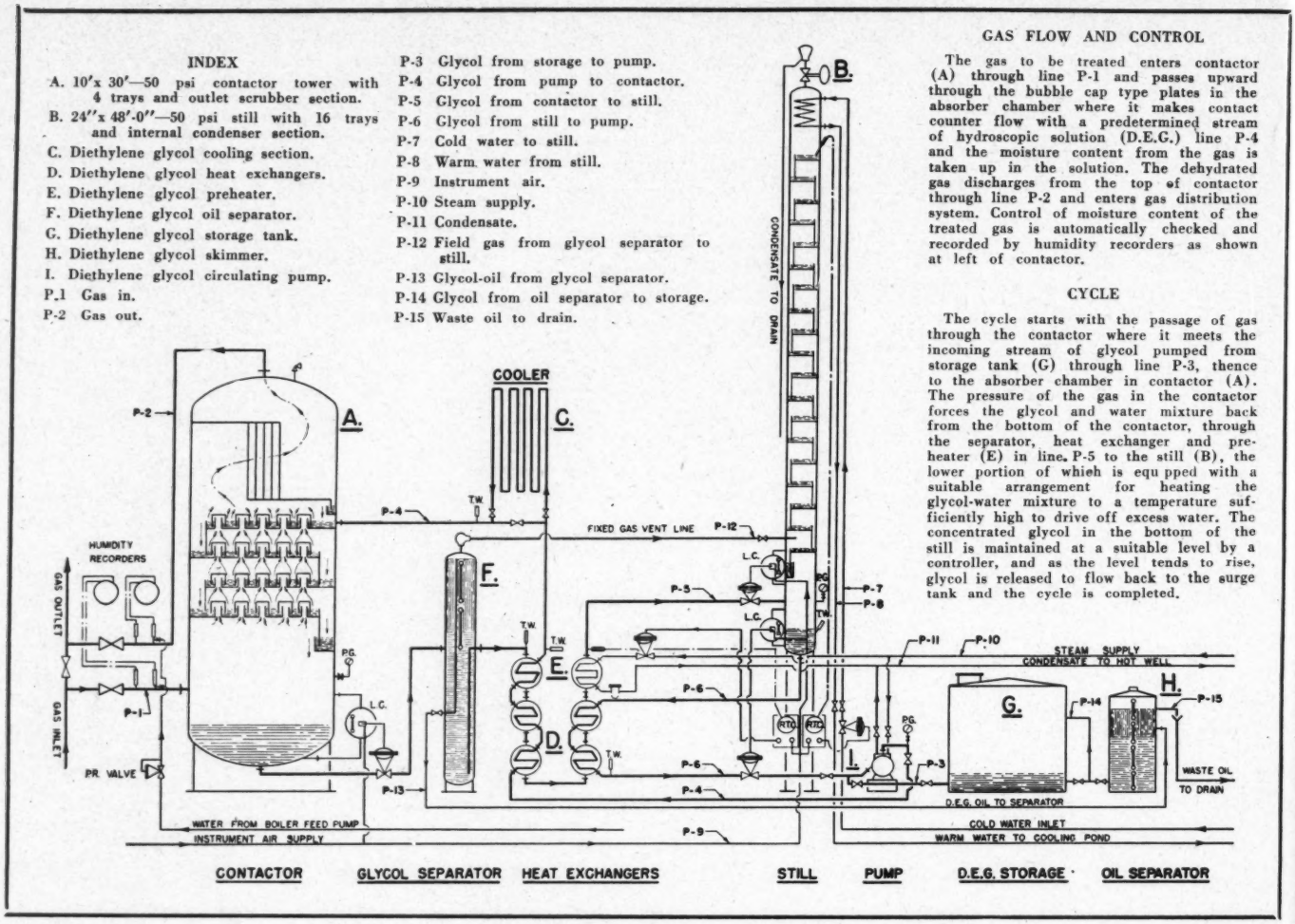

INDEX
A. 10'x 30'—50 psi contactor tower with 4 trays and outlet scrubber section.
B. 24"x 48'-0"—50 psi still with 16 trays and internal condenser section.
C. Diethylene glycol cooling section.
D. Diethylene glycol heat exchangers.
E. Diethylene glycol preheater.
F. Diethylene glycol oil separator.
G. Diethylene glycol storage tank.
H. Diethylene glycol skimmer.
I. Diethylene glycol circulating pump.
P-1 Gas in.
P-2 Gas out.
P-3 Glycol from storage to pump.
P-4 Glycol from pump to contactor.
P-5 Glycol from contactor to still.
P-6 Glycol from still to pump.
P-7 Cold water to still.
P-8 Warm water from still.
P-9 Instrument air.
P-10 Steam supply.
P-11 Condensate.
P-12 Field gas from glycol separator to still.
P-13 Glycol-oil from glycol separator.
P-14 Glycol from oil separator to storage.
P-15 Waste oil to drain.
GAS FLOW AND CONTROL
The gas to be treated enters contactor (A) through line P-1 and passes upward through the bubble cap type plates in the absorber chamber where it makes contact counter flow with a predetermined stream of hydroscopic solution (D.E.G.) line P-4 and the moisture content from the gas is taken up in the solution. The dehydrated gas discharges from the top of contactor through line P-2 and enters gas distribution system. Control of moisture content of the treated gas is automatically checked and recorded by humidity recorders as shown at left of contactor.
CYCLE
The cycle starts with the passage of gas through the contactor where it meets the incoming stream of glycol pumped from storage tank (G) through line P-3, thence to the absorber chamber in contactor (A). The pressure of the gas in the contactor forces the glycol and water mixture back from the bottom of the contactor, through the separator, heat exchanger and pre-heater (E) in line P-5 to the still (B), the lower portion of which is equipped with a suitable arrangement for heating the glycol-water mixture to a temperature sufficiently high to drive off excess water. The concentrated glycol in the bottom of the still is maintained at a suitable level by a controller, and as the level tends to rise, glycol is released to flow back to the surge tank and the cycle is completed.
COOLER
CONDENSATE TO DRAIN
FIXED GAS VENT LINE
HUMIDITY RECORDERS
GAS OUTLET
GAS INLET
PR. VALVE
STEAM SUPPLY
CONDENSATE TO HOT WELL
WASTE OIL TO DRAIN
D.E.G. OIL TO SEPARATOR
WATER FROM BOILER FEED PUMP
INSTRUMENT AIR SUPPLY
COLD WATER INLET
WARM WATER TO COOLING POND
CONTACTOR
GLYCOL SEPARATOR
HEAT EXCHANGERS
STILL
PUMP
D.E.G. STORAGE
OIL SEPARATOR

FIG. 1. Flow diagram of diethylene glycol gas dehydrating plant.

6. Diethylene Glycol Dehydration Plant

THE major part of the gas supply for the City of Long Beach is treated at the plant of the Wilmington Gasoline Co. at Terminal Island for removal of water. This plant which was completed in October, 1945, operates at relatively low pressure and the saturated gas has a high specific water content.

The plant was built because the gas department had experienced considerable trouble with water condensate in the distribution system, particularly in the winter months. A study was made of the average and peak loads and a plant designed that would remove sufficient water from the gas to prevent condensation in the distribution system when operating at winter rates and allowing sufficient humidity during the lighter loads to prevent dust formation in the distribution system and the drying up of meter diaphragms.

The plant is capable of reducing the dew point of 15 MMcf of gas a day more than 30°. This results in the removal of approximately 5250 lb. of water per day when the entering gas temperature is 80° F and the pressure 36 psi.

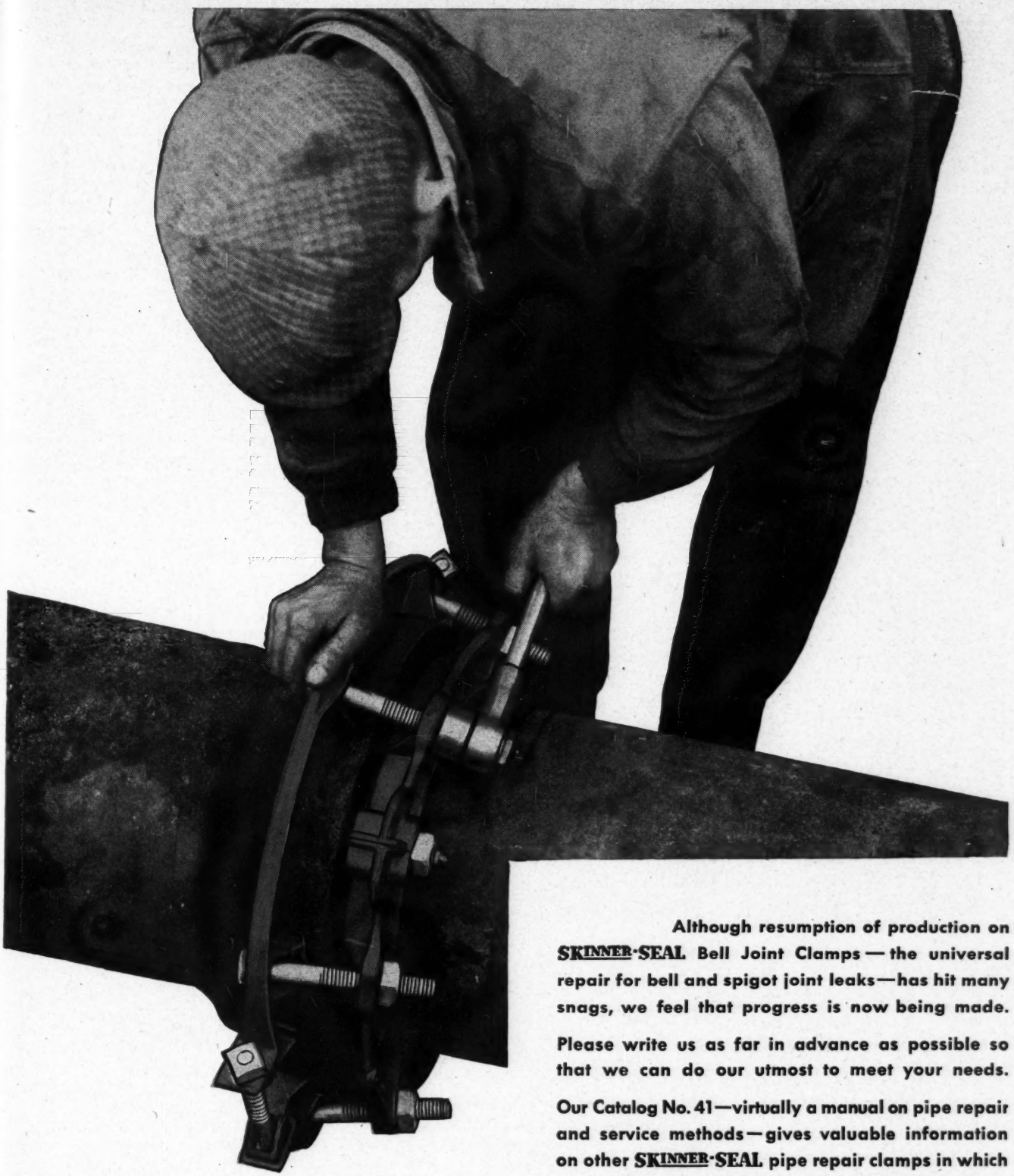
To lower the humidity, all or part of the gas is introduced into the lower section of a 10 ft. diameter x 30 ft. high contacting tower at the gasoline plant exit pressure which is 36 psi.

The wet gas passes upward at low velocity through four bubble type contact plates and through a vertical baffle type mist extractor, to remove any liquid carryover, and is piped from the top of the tower to the meter runs for measurement into the distribution system. Fig. 1 shows a flow diagram of the dehydrating plant.

Humidity recorders installed on both the incoming and outgoing gas lines provide a continuous record of the reduction in humidity. The amount of this reduction can be controlled by varying the rate of flow of the dehydrating medium or by by-passing part of the gas from the plant or a combination of both. With a definite continuous knowledge of the amount and water content of the dehydrated gas any desired humidity in the distribution system can be maintained.

Diethylene glycol is used as the dehydrating medium and is pumped into the top plate of the contacting tower by a 6 x 12 x 5 simplex steam pump. The liquid is contacted by the gas in the bubble plates picking up water from the gas and is forced from the bottom of the tower by the pressure of the gas through a continuous oil separator for removing any absorber oil that might carry over from the gasoline plant and then through a heat exchanger and a preheater to the still.

The still which is 24 in. diameter x 48 ft. and contains 16 trays operates at practically atmospheric pressure. The temperature of the still bottoms is held at 265° F by a temperature re-



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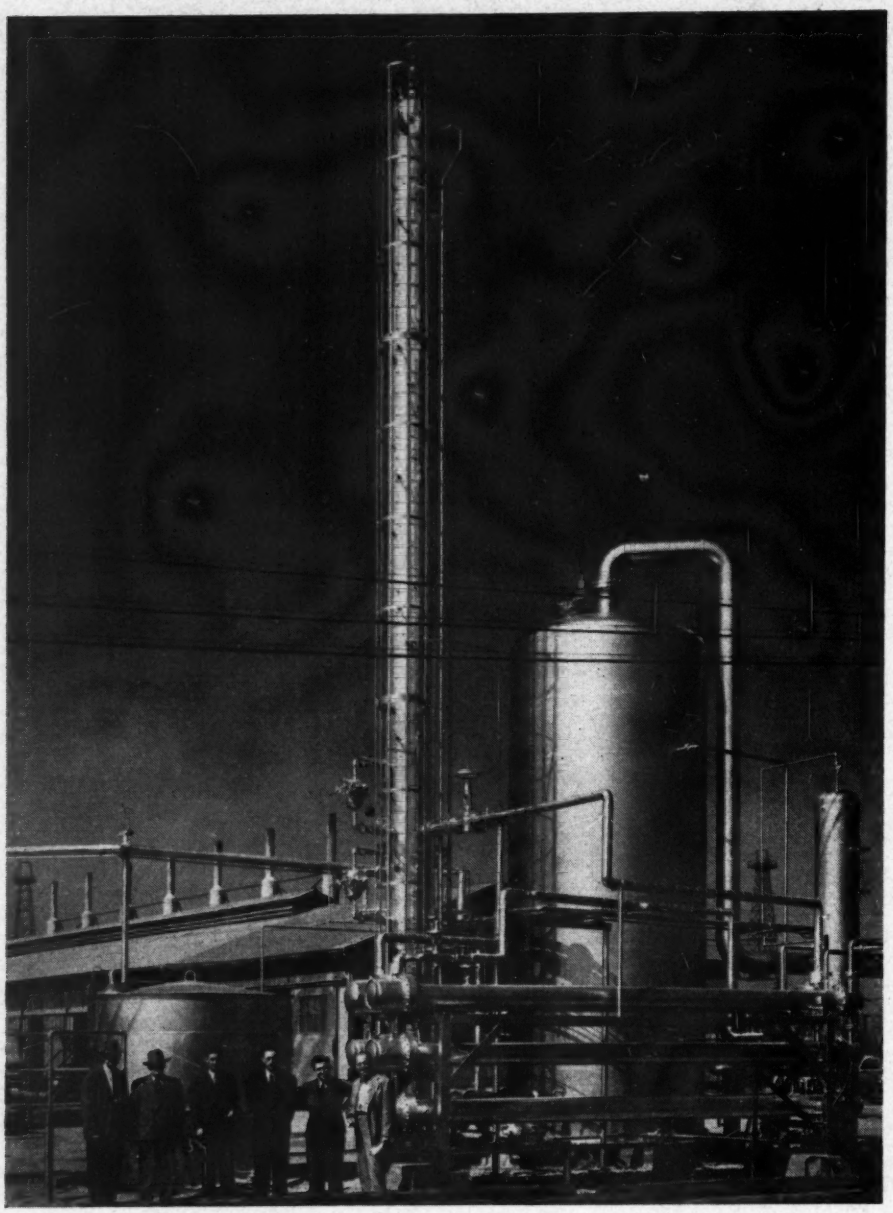


Fig. 2. View of the completed plant.

cording controller which varies the flow of steam to the preheater. The element of the controller is located in the base of the still which is below the flash tray. As the flow rate of the diethylene glycol is relatively constant, the steam to the preheater is constant excepting for the variation in heat required to supply the latent heat to evaporate the water picked up by the diethylene glycol. The temperature from the preheater is free to vary with increasing water content and approaches tower bottom temperature when moisture picked up is low. This method of control eliminates the need for a reboiler.

The water flashed off as steam is exhausted to atmosphere from the top of the column. An internal condensing coil is located in the top section of the tower holding the outlet temperature to 225° F by use of a temperature control which varies the rate of flow of water through the coil.

The hot glycol from the base of the still flows by gravity through half the heat exchangers to a line manifolded to the combination surge and storage tank and the pump suction. This provides a positive suction to the pump as even if the flow from the base of the tower should vary the pump is supplied constantly. From the pump the DEG is forced through the balance of the shell and tube exchangers into a cooling coil located in the cooling tower and then into the contactor.

A level is maintained in the base of the contactor by a level control operating a motor valve on the liquid outlet line. Inasmuch as the liquid content of the system is greater than the capacity of the still, a high level shut-off control is located a few trays above the flash tray which will shut off the flow to the still in case the controller on the contactor should fail to function.

The plant has been in operation for five months and has treated a total of 1902 MMcf of gas up to April 1.

Glycol consumption is a function of the inlet gas temperature as the loss is due to absorption by the gas. Mechanical carryover is nil, due to low velocity in the contactor and an efficient mist extractor. Fig. 2 shows the completed plant.

The contract for the design of the plant was awarded to Swinerton & Walberg Co. of San Francisco and Los Angeles under the direction of Harold W. Wickstrum, consulting engineer. The construction contract was performed by the Oil Field Construction Co. of Long Beach. The plant is owned by the City of Long Beach Gas Department and operated for them by the Wilmington Gasoline Co.

McKinley Heads Thermac, Formerly H-M Regulator Co.

With the same top management headed by I. E. McKinley, president, the Thermac Co. of Los Angeles, formerly H-M Regulator Co. and earlier the H-M Thermo Control Co., is producing the old line of H-M low pressure regulators. Other officials are J. H. Turner, secretary, and R. J. Draper, treasurer.

H-M regulators are now built of all aluminum for lightness and ease of handling, with internal parts of corrosion resistant materials. A complete line of A.G.A. approved regulators ranging in sizes from ⅜ to 1½ in. is offerred by the Thermac Co. With each individual regulator factory tested, adjusted and sealed for the customer's requirements, Thermac with its complete production foundry and high speed maunfacturing facilities maintains rigid control of quality and product performance.

Known Petroleum Reserves Decrease in 1945

The API Committee on Petroleum Reserves has made its report on reserves which shows that as of Dec. 31, 1945, the net loss from known reserves of petroleum was 1.3 billion bbl. Petroleum produced in 1945 totaled 1.7 billion bbl., but new pools amounted to only 419.9 million bbl.

State Seizes Gas Plants

On April 5 the State of New Jersey seized and began operating nine gas plants to prevent a walkout which would have cut off service to 3 million consumers. The action—first of its kind ever taken by a state government—was made under an eight-day-old anti-strike law, invoked by Gov. Walter E. Edge in order that "the public interest, health and welfare shall not be interfered with."

Arkansas Gas Companies To Create Rebate Fund

The Arkansas Public Service Commission has ordered the Arkansas Power and Light Co. and the Arkansas Louisiana Gas Co., Shreveport, to create special funds for rebate to their customers in 22 Arkansas cities and towns, following a ruling of the Federal Power Commission lowering the wholesale rate of gas sold to the two companies by the Mississippi River Fuel Corp., St. Louis. The FPC order was effective Jan. 20, and an appeal was taken from the ruling.

Should the ruling be upheld, the two companies serving Arkansas must show cause within 30 days why they should not refund the savings to their customers and submit a revised rate schedule.

The proposed rebate by Arkansas Louisiana would mean a return of about $25,000 to customers at Hamburg, Warren, Monticello, Star City, England, Lonoke and Carlisle.

The rebate for which Arkansas Power and Light would be liable to customers at Alicia, Bald Knob, Batesville, Hoxie, Jonesboro, Judsonia, Kensett, Newark, Newport, Searcy, Tuckerman, Walnut Ridge and Diaz would total approximately $60,000.

Film Catalog Available For Schools and Industries

Castle Films, Inc., 30 Rockefeller Plaza, New York, N. Y., has published a new catalog fully describing what is believed to be the largest single collection of educational and teaching films now available to schools and industries. The catalog contains a complete list of 1158 government 16mm sound films and 35mm filmstrips. The supervised productions were made by 36 motion picture companies.

Utility Appliance to Issue Stock for Expansion

Utility Appliance Corp., Los Angeles, has filed registration with SEC regional office proposing issue of 80,000 shares of cumulative preferred stock and 80,000 shares of $1 par value common stock. Proceeds will be used principally for purchase of two partnerships, Gaffers & Sattler and Occidental Stove Co., Los Angeles, for $1.1 million, and for plant equipment and tooling and working capital.

Cities Service Gas Co. To Construct Pipe Line

Cities Service Gas Co. will construct a $25 million pipe line from Kansas City to the Hugoton field in 1947, according to S. B. Irelan, president. He stated that the 26-in. line, 405 miles long, will be the largest project ever undertaken by the firm. The line will deliver 290 MMcf daily to the Kansas City area, increasing the total volume there about 50% on peak delivery days.

All-Canadian Gas Plant Being Built in Vancouver

Construction is under way for the first all-Canadian gas plant ever to be built, for the British Columbia Power and Gas Corp., Ltd., at its Carrall Street works in Vancouver. The new unit will cost $600,000 and contract has been placed with the John Inglis Co., Ltd.

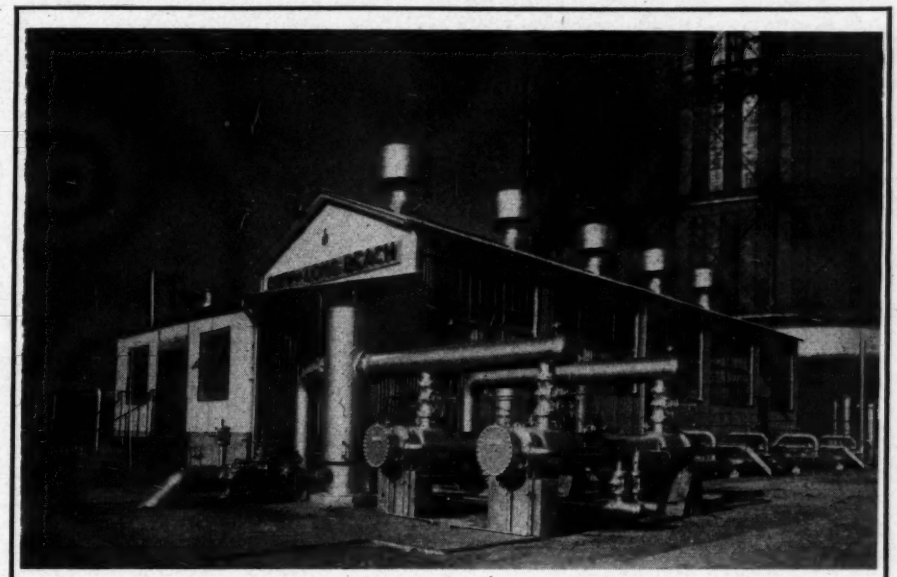
With a peak capacity of 4.5 MMcf of gas every 24 hours, the plant will increase the company's gas-producing capacity in Vancouver to nearly 14 MMcf of gas per day. Construction will proceed as rapidly as practicable, Inglis officials said, since an "in operation" deadline has been accepted for not later than Dec. 1, 1946.

The new unit will use the carburetted water-gas process. Power Gas Corp. of Stockton-on-Tees, England, specialists in this field, designed the plant. A similar unit, costing $250,000, is under construction in Victoria for the same company.

Southern Natural Gas Co. To Reduce Wholesale Rates

The FPC announced April 4 its order directing Southern Natural Gas Co., Birmingham, to reduce its wholesale rates for gas sold in interstate commerce for ultimate public consumption by not less than $1.2 million annually. Such rate schedules are to be effective as of May 1.

At the same time, the Commission authorized the company to transfer from its reserve for depreciation of gas plant to its surplus account, the amount of $6,668,134 reflecting the difference between the depreciation reserve shown on the books and the requirements as of Dec. 31, 1945.



North Long Beach Compressor Plant

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Finding Facts

. . . About Your Customers

By THEODORE H. BROWN

Harvard Business School

LET us assume that a certain gas company is giving serious thought to postwar company problems. One of these relates to the possibility that some householders in removing the wartime installed coal grates in their central heaters will wish to reconvert to gas rather than back to oil which they had in prewar days. Polling the customers of the company might provide the needed facts for use in formulating plans, but taking a census of all these homes might entail a burden of work as well as a cost that would be unwise. But it is recognized that a census is often unnecessary because a sample will do the trick.

The concept of a sample is that it shall be a direct counterpart of the larger population which it is presumed to picture. If the sample does this then presumably the values obtained by examining the sample will correspond to those which would be obtained if a complete census were undertaken. The modern election polls are based upon a sample in which great care is exercised to assure that it will be representative of all of the various groups and components which make up the electorate. Only in this way can such a poll prove to be successful.

In comparison with a census, information gathered by a sample represents a decided short cut in time as well as in money. In modern marketing research there is great dependence upon the use of samples to provide fundamental information.

Knowing the Objectives

One key problem occurs in the first step of organizing a sampling procedure. This is the act of precisely defining the objective to be reached. The difficulty occurs because slight changes in the objective may require radical changes in the subsequent sampling procedure. Many are puzzled by the difficulties which ultimately arise when precision and care are not used in this particular part of the work. Executives often pass by the preliminary prosaic step of defining objectives in their rush to get at the more active parts of the investigation. In the case of the gas company, the problem involved finding out what people intend to do about converting the central heating plant from coal to gas or oil. If the objective is thought of as a problem of finding out how many people are "interested in" the use of gas in their central heating system, little will be gained.

The Ways of Planning Samples

Since a sample is a small counterpart of the whole population which is to be examined, one of the important steps is the plan by which the sample is to be taken. This is usually termed the "sample design."

Sample design is based upon two things: one is the survey objective to be attained and the other is the definition of the market or the "population" which the sample is intended to represent.

Immediately following the work of defining the objective, there is the necessity of recognizing certain implications regarding the character of the survey. Two extremes may be noted. If a picture or a pattern only is desired, then a relatively few cases may be sufficient to develop the outlines of opinion which are present in the minds of various householders. Thus, in the case of a survey objective for the problem of the central heating plant noted above, if the objective is that of finding out what householders as representing the general public think and feel in regard to gas as a fuel for their central heating plant, only a relatively few cases will be necessary to bring to the fore the basic points which are present in the minds of consumers. There is implied here no measurement of the size of the market, nor is there any intention of making such a measurement. The objective rather is that of obtaining the attitude of the market toward gas heating and the pointing up of certain issues which may be classified in general terms as popular opinion.

This question of size is inter-related with the survey objective and the design of the sample. For the case just noted, it is very likely that 25 or 50 cases wisely and well distributed throughout the appropriate part of the community may give all of the information that is needed. Such a size sample, however, is far too small to result in a satisfactory measure if another type of survey objective is prescribed. Another illustration will present this case.

In contrast to a study of the character of general public opinion there might be considered the desirability of measuring consumer intentions in regard to water heating appliances. Suppose that the study is also limited to the customers of the Gas company. The survey objective could then be broken down into type of present appliance, condition of that appliance, ability to purchase new equipment, kind wanted and so on.

500-Customer Measure

For such a sample the customer list obviously represents the total population. A sample of 500 customers properly distributed should give a reasonably good measure of intentions of the 25,000 customers of the company. This means that one case out of about 50 customers will be selected for the sample. If the customer list is on cards, two samples may be drawn: one being take from every fiftieth card and the other from every hundredth card. The two halves of the sample called A and B then should be matched in relation to certain customer habits such as the monthly consumption of gas or the location of the home. This is to insure that the two parts of the sample are alike in regard to customer volume and in re-

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HERE ARE some thoughts on the procedures, problems, and pitfalls which confront the sales manager when he undertakes to settle a question by finding out what a sample of the public thinks about it. Mr. Brown delivered this paper before the 20th Meeting of the New England Gas Association which convened in Boston on March 21 and 22.

Here's the

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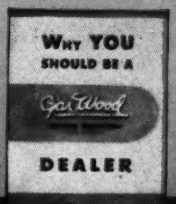

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gard to the location of the home. Such a requirement does not mean that the cards have to be paired but simply that in each group of 250 customers there should be about the same number of homes in A and B from the high rental areas, the same number in A and B from the medium rental areas, and the same in A and B from the low. Other factors for matching the two parts of the sample will come to mind. If now the two halves of the sample show the same characteristics, it may be assumed that the sample is adequate in design to represent the customers of the company.

In turn the size of the sample for this survey objective is substantially larger than the size of the sample noted above. In this case, however, it is presumed that the objective is not so much that of defining the ideas which are present in the public mind as it is that of measuring the demand for certain types of appliances. It is likely also that the errors of sampling are present so that the numerical values obtained for this size of sample might be in error as much as 6 or 8%. If such a liability is too great, the sample size must be multiplied by four if the error is to be cut in half.

Equation for Accuracy

Accuracy of a sample varies as the square of the number of cases to be taken. Thus, if an error is to be cut in half the sample size must be multiplied by four; if it is to be made a third of its previous value, the sample size must be multiplied by nine and so on. This question of sample size leads immediately to the problem of deciding whether high accuracy is worth the cost. Frequently executive action can be based upon small samples because it is not necessary that a measure of high accuracy shall be obtained. Thus it might be entirely possible to cut the sample of 500 in two or even to use 150 cases.

In the example cited the design has been such that it could be planned with relative ease. Suppose now that some attitude of the whole community toward the use of gas were desired. This means that the sample must represent all homes within the territory. Recourse cannot be had to the customer list since important parts of the population may not use gas at all and yet the attitude of these omitted people may have an important influence upon the total community feeling. Similarly the telephone book cannot be used for a sample basis since many homes do not possess the advantage of a telephone. In such cases the whole territory must be mapped and subdivided. Information regarding wards or census areas are extremely helpful. Data from the Chamber of Commerce, from the local government, as well as from the Census, may provide the basis for a preliminary subdivision of the whole area. There must follow detailed studies of each section. The result of these studies will be the sorting of areas into groups and the selection of certain ones within which a sample of homes is to be drawn.

Some Right and Wrong Ways in Questionnaires

After the objectives have been defined and the sample designed, the next step in the process is to plan for the questionnaire. The first thought of many people in regard to questionnaire plans is the use of a mail questionnaire. This is really a problem of design as much as it is a problem of questionnaire writing. The mail questionnaire can be dismissed with the comment of one research expert that there were two things definitely known about it: the first of these is that it is sent by mail and the second is that it is almost invariably biased. People who answer a mail questionnaire frequently are those who do so because they have some axe to grind; the unbiased want to file the questionnaire in the wastebasket.

The next item to be noted is whether the questionnaire is designed as a case study or whether it is designed to obtain factual information.

In the case of merchandise the questionnaire writing requires that an understanding of appliances shall be presented in such a form that valid answers from interviews can be obtained. One manufacturer remarked that housewives select the high location of oven when they look at pictures presented in a survey but actually buy the ranges with the oven inconveniently located below the level of the burners. This particular manufacturer had concluded that sampling surveys produced unsatisfactory results. The real trouble was that his questionnaire had not been properly organized.

Another problem in questionnaire writing requires that the design of a questionnaire be directed toward the buyer of the goods in question. Quite different answers to the same set of questions may be obtained from the husband and from the wife. To some extent this particular difficulty may be overcome through the form in which the questions are presented. Instructions for these situations should be covered by a full set of written directions furnished each interviewer.

One of the most common types of faulty questions might be classified as the sales promotion type. The question is not phrased so as to permit the individual a simple or easy personal reply. Most people have had too much schoolroom experience in trying to please the teacher. Any lead no matter how slight or even unconsciously biased may secure biased answers from almost anyone. Such types of questions must be scrupulously avoided. Interviewers must be trained so that there is no forcing of a particular answer. The question, "You own an electric range, don't you?" can carry such an inflection of the voice that Mrs. Jones feels that she must answer "yes" in order to be respectable.

Before actual use there is the need for pretesting a questionnaire. This consists of trying out the questionnaire upon individuals who may be available either in the office or in the immediate neighborhood of the office. The results obtained from such questionnaires should be carefully scrutinized to discover those questions which seem to be misleading or which seem to introduce a predetermined pattern of answers.

Insuring the Quality of the Results

A final step is the act of validating the sample. The act of validation includes the work of comparing the collected facts with known facts for the whole population. For this purpose the questionnaire often carries items in addition to those for which the sampling survey has been organized. Thus a householder is asked whether he has a telephone and a mechanical refrigerator. The percentage from the sample for each of these "check" items should match the percentage for the community. The assumption is that if the sample carries the correct proportion for each of several check items in comparison with the proportion for the community, then the sample is in balance in respect to the unknown elements for which the sampling survey has been conducted.

Consolidated Edison Co. Issues Report to Employees

Consolidated Edison Co. of New York, Inc., has issued its annual report to employees, which shows the effect of the war on one of the largest groups of employees in the metropolitan area. The average weekly pay of employees has risen more than 60% in the past 10 years, to an average of $53.22. The report includes a memorial listing of the 91 System employees who died serving their country in World War II, and states that 2978 are still on military or wartime leave.

PROMOTIONAL NOTES and NOTIONS

By STANLEY JENKS

Again We Meet

Cincinnati is an outstanding example of an industrial metropolis that owes much of its sturdy development to the availability of natural gas service over the years. It is a good and logical place for the Natural Gas Department of the A.G.A. to hold its first post-war Annual Spring Meeting.

Just as Cincinnati is fortunate in having natural gas service, our industry, particularly for this conference, has been equally fortunate in having Walter C. Beckjord, president of the Cincinnati Gas & Electric Co., on the job as chairman of the program committee.

Mr. Beckjord and his co-committeemen know the natural gas industry thoroughly. They appreciate its war generated problems, and have undoubtedly studied its future requirements very completely. The conference program amply supports this viewpoint.

The natural gas industry's war job has been remarkable. Few people outside the industry realize that approximately four-fifths of the gas used in the United States is natural gas. According to the A.G.A., for the year ending February 28, 1946, natural gas therm sales were estimated at 21,940 million, compared with 2966 million therms for manufactured and mixed gas.

And E. L. De Golyer, of Dallas, Texas, an outstanding petroleum geologist, recently testified at a Senate hearing that he estimates U. S. reserves of 200 trillion cu. ft.

So, with inevitable new discoveries and encouraging results daily from deeper drillings of present facilities, the industry can and will contribute substantially for many years to the social welfare and economic development of our country.

Basic

Private enterprise, whether you are making shoe buttons, shock absorbers, or what have you, has one basic problem. It must earn a return sufficient to service and support its funded indebtedness and pay enough to its equity stockholders to justify their investment in the business. The manufacturer, for example, must operate (post-OPA, I mean) under price limitations established in a competitive market. The utility can only charge what the public approves. In an inflationary period like this, despite holding-the-line doubletalk, the squeeze is on the utility. Its labor and materials are costing more. The maintenance of its inflated wartime load is contingent on factors beyond its control. The only alternative to a rate increase is usually a better than wartime load.

Even the sales problem has an inflationary angle, and that is the compensation of salesmen. They have to eat and satisfy the inflated demands of their families.

Somebody has estimated that our salesmen, under today's living costs, are entitled to 40% more than they were paid pre-war. Like most generalities, such an estimate must be given a local treatment. Where is it to come from in a profit-squeezed industry like ours? Not from ruthless, non-cooperative appliance selling, I hope. That certainly would be atom bombing our long-range development program.

It is my experience that the economic solution of any sales problem is not necessarily the correct one.

The correct answer lies in a properly balanced utility-dealer promotional program, in which load values are properly appraised, and with the salesman's compensation determined by the added load he and the cooperating dealers are able to get.

Selling Organization

The other day, I was asked whether it is better *for the time being* to sell (a) through a skeleton organization with large territories or (b) add more men and reduce the size of each territory. The answer is not so simple as it seems at first glance.

For the time being, there is no sales problem with gas appliances. Our problem is getting the appliances to sell, and, until the "bottleneck" of material and productive labor is eliminated, no salesmanship—getting out and creating a demand—is needed. The bureaucratic longhairs are fixing all that.

But only those lads with their heads still in the clouds have any illusions about the forthcoming "battle of the fuels," with even our base cooking load at stake. Our electric competitors, after the cooking load on an incremental basis, are pulling no punches, as any reader of their advertisements can readily check.

The only effective way to face the fight is not with a bunch of amateurs, no matter how enthusiastic they may be, but with well trained and experienced professionals. We know our fuel is superior and our appliances are better than theirs, but do Mr. and Mrs. John Q. Public? I doubt it, because, from a long experience selling the public, I am convinced Mr. and Mrs. John Q. Public know precious little and remember less, without constant prodding. Only an expert can do this without making himself a pesty pain in the neck.

That is why, with so much of our future at stake, I am entirely in favor right now of assembling as strong a sales force as possible and using this period of grace (or sumpin') to make the sales organization competent enough to pin back the ears of each and every fuel competitor who threatens our security.

Analyses of Complex Hydrocarbon Mixtures with

The Mass Spectrometer

EXCERPT from the "Technical News Bulletin" of the National Bureau of Standards, Aug. 1945 issue.

THE analyses of complex hydrocarbon mixtures can be made on the mass spectrometer* with a high degree of precision. As explained by A. Keith Brewer and V. H. Dibeler in the August Journal of Research (RP1664), the basis for the analyses lies in two parenthetic facts: First, that molecules of all hydrocarbons when bombarded by 50- to 100-volt electrons are not only ionized but are broken down into every possible disintegration fragment; and second, that while the appearance ratios of these fragments is always the same for a given hydrocarbon, the ratios are never the same for different hydrocarbons.

A mass spectrometer record for any hydrocarbon consists of a series of peaks, the heaviest being for that of the normal molecule, whereas the rest of the peaks are for the various possible fragments resulting from a loss of hydrogen atoms or C atom groups. The mass spectrometer record for a mixture of hydrocarbons is the sum of the peaks for the various constituents wherein each contributes in exact proportion to the amount present in the mixture. The analysis of such a composite record consists in subtracting the contributions of each possible constituent. Mixtures containing over 20 compounds have been precisely analyzed at the Bureau.

The agreement of results of individual analyses is high. Almost invariably independent analyses will agree to within a few tenths to a few thousandths of 1% for the concentration of each component. The absolute accuracy, however, may or may not be as great as the reproducibility. While accuracy is principally dependent on the agreement between analyses, it is also dependent on the purity of the materials used for calibration and on a number of other factors, which are not necessarily constant from day to day. In test analyses where the composition of the sample is known, the precision has been found to agree to within the limits of uncertainty in the sample.

*"The Mass Spectrometer—A Tool for Chemical Research and Industry" by H. W. Washburn, H. F. Wiley, S. M. Rock, and C. E. Berry, appeared in G A S, May, 1945, page 28.

Training Program for Employees

A comprehensive training program for supervisory employees of the Arkansas Power & Light Co., Pine Bluff, will be planned in operation under Personnel Manager Clyde V. Hussey.

Reeves Ritchie, formerly assistant superintendent of the Little Rock power plant, will assist Hussey in presenting the plan.

Embracing a series of some 125 meetings, this "Make Our Company The Best" program feature is built around training more than 200 employees in supervisory jobs in the fundamentals of business in general and the company in particular.

The plan calls for a series of meetings to discuss management and supervisory problems and provide information and additional data to all supervisory employees. The program calls for approximately 125 meetings in order to provide the complete course of eight meetings for each participant at eight different locations. In most of the locations, two meetings will be held, covering the same material, in order to divide the employees into two groups so that regular operations can be carried on without interruption.

The supervisory training series of films and records will be used as a vehicle in following the program through on an objection basis. The film requires about 30 minutes, leaving an hour and a half for discussion period. During this period the application of the principles discussed in the film to everyday problems will be followed; this to be supplemented by additional information and material of an informative nature covering subjects such as economics of the utility business, governmental operation of utilities, regulation of utilities, federal, state and municipal matters affecting business-managed utilities, etc.

As general company information for employee use is prepared, it will be presented at these meetings at the appropriate point in the discussions. Material will cover information such as financial structure of the company, functions of the various departments, rate reductions, taxes, rural electrification, and other facts and statistics about the company. Discussion of company policies such as those covered in the employee booklet, engineering specifications, job specifications, safety rules, rates, rural line policies, state development and other company programs as the need for such material arises, preferably in response to specific questions or requests resulting from discussions.

There is a place somewhere in the eight discussion subjects scheduled which provokes discussion and "points up" the need for information on all of the subjects and phases of the utility business. There is a complete copy of an outline covering discussion of the film to be given to each man together with additional prepared data, discussions, lectures, pamphlets, booklets, etc., for review before the next meeting. It is planned that a considerable portion of this information and material will be made available to and discussed with the individual employee groups working under the various supervisors attending these meetings.

After discussion series is completed, it is planned to have a program consisting of published booklets and other informative material ready for further employee educational meetings.

One advantage in this program is that present supervisory people play an important part in developing the type of information needed for these booklets, will have a stake in their preparation, and a wider interest in following through with the general employee program which will follow. Each supervisor will be furnished with a copy of the booklet entitled "Management Standards for Supervisory Personnel" which will be supplemented with additional prepared material at each meeting as outlined above.

Attendance records will be maintained for each supervisor participating, showing the date each meeting is attended, together with an indication of his participation and application of the matters discussed at the meeting.

Several associated programs are also under way and under preparation. These all have been planned as units of the general program, and are aimed at training all employees in policies, practices, history and plans of the company.

GAS MEN
in the Spotlight

ABOVE. Present at the March A.G.A. rate committee meeting were: Seated, left to right: **S. S. Mason,** Washington Gas Light Co.; **N. E. French,** Equitable Gas Co.; **F. C. Beck,** United Gas Pipe Line Co.; **L. R. Lefferson,** Ebasco Services Inc.; **Kurwin R. Boyes,** A.G.A. secretary; **C. S. Reed,** Duke Power Co. Standing: **Robb Quinby,** The Brooklyn Union Gas Co.; **A. I. Phillips,** New York, N.Y.; **W. T. Bauer** Petroleum Advisers, Inc.; **F. M. Terry** and **R. M. Fouse,** Consolidated Edison Co.; **R. M. Keeney,** Connecticut Light & Power Co.; **E. P. Kramer** and **R. E. Keller,** Ebasco; **B. P. Dahlstrom,** Public Service Electric & Gas Co.; **C. L. Follmer,** Consolidated Gas Electric Light & Power Co. of Baltimore; **E. N. Strait,** Public Utility Eng. & Service Corp.; **I. L. Craig,** Philadelphia Electric Co.

ABOVE. Newly elected 1946-47 NEGA officers are, front row, left to right: **James A. Cook,** 1st vice president (general manager, Lynn Gas & Electric Co.); **L. E. Knowlton,** president (engineer, Providence Gas Co.); **Edward G. Twohey,** 2nd vice president (assistant district manager, Worcester County Electric Co.). Back row, left to right: **Otto Price,** treasurer (vice president in charge of accounting, Boston Consolidated Gas Co.); **Clark Belden,** clerk (executive secretary).

RIGHT. Maj. D. C. Artman, acting post commander at Camp Breckinridge, Ky., pins the medal of the Legion of Merit on former **Lt. Col. J. Paul Tobin,** while Mrs. Tobin looks on. Col. Tobin was cited by the War Department for outstanding services on the staff of **Gen. Douglas MacArthur.** He is now connected with the air conditioning division of Servel.

BELOW. At a recent meeting of the engineering and research staffs of the Nordstrom Valve Co. and Edward Valves, Inc., subsidiaries of Rockwell Manufacturing Co., a long-term program to retain the advantages of separate operations with exchange of technical design, research data and summaries of investigations was formulated. Back row, left to right: **E. E. Matheson,** sales manager, Nordstrom Valve Co.; **A. J. Kerr,** vice president of sales, Rockwell Manufacturing Co.; **E. E. Hedene,** chief engineer, Oakland plant, Nordstrom Valve Co.; **W. F. Rockwell, Jr.,** vice president and general manager, Rockwell Manufacturing Co.; **C. B. Johnson,** chief engineer, Pittsburgh plant, Nordstrom Valve Co.; **W. A. Marsteller,** vice president, Edward Valves, Inc.; **David MacGregor,** chief engineer, Edward Valves, Inc.; **W. F. Crawford,** president, Edward Valves, Inc. Front row, left to right: **G. F. Scherer,** director of research, Nordstrom Valve Co.; **L. H. Carr,** director of research, Edward Valves, Inc.

BELOW. Gild of Ancient Supplers breakfast during SGA convention. Standing, left to right: **H. E. Howerton,** Peerless Mfg. Co., Kansas City, Mo.; **Romus T. Bergh,** George D. Roper Corp., Kansas City, Mo.; **J. C. Mansfield,** George D. Roper Corp., Dallas; **Carl Liden,** Ohio Foundry & Mfg. Co., Fentree, Texas; **L. W. Timberlake,** Combustion Engineering Co., Chattanooga, Tenn.; **F. K. Toney,** Combustion Engineering Co. Charlotte, N. C.; **A. S. Kincaid,** Ward Heater Co., Los Angeles; **W. W. Hall,** General Gas Light Co., Dallas; **Bert P. Fisher,** Southern Furnace & Supply, Houston. Seated, left to right: **Marc Gilbert,** Pittsburgh Equitable Meter Co., Tulsa; **S. D. Day,** Pipe Line Service Corp., Houston; **Carl Sorby,** George D. Roper Corp., Rockford, Ill.; **D. S. Sharpe,** George D. Roper Corp., Atlanta.

ASSOCIATIONS

Mid-West Group Holds 41st Meeting

AT the call of president B. R. Bay, of Omaha, Neb., 333 members of the Mid-West Gas Association assembled in St. Paul, Minn., for the 41st annual meeting and convention of the association, April 8 through 10.

The how-to-do aspect of every phase of utility management and operations, from selling appliances to accounting and distribution practices took precedent over all other interests in the three general sessions and six section meetings listed on the program.

Of particular interest in light of the baffling slowness with which post war deliveries of appliances and equipment are being made, was the discussion of both the problems and the plans of the stove, water heater, refrigerator and heating equipment manufacturers.

E. Carl Sorby, vice president of the George D. Roper Corp., Rockford, Illinois, brought a practical viewpoint to bear when he told the assemblage that the business of merchandising cannot wait until the ultimate in luxury in appliances has been achieved. The immediate problem in the opinion of this speaker is to get out and sell what is available now, keeping constantly alive an advertising and promotion program that will lend promise for the future when that future arrives.

H. Carl Wolf, managing director of the American Gas Association, and E. P. Noppel, general consultant with Ebasco Services, Inc., both of New York, headed the list of a number of speakers who touched on the recent progress of the industry as a whole, and who anticipated in detail the plans that are now being laid for future expansion of cooperative activity in research, promotion and advertising.

The growth of liquefied petroleum gas as a possible substitute for manufactured gas, or as a low plant investment standby fuel was a leading topic of discussion in the sessions of the operating section of which D. J. Reimers of St. Peter, Minnesota, was chairman.

Consideration of the numerous promotion plans of appliance manufacturers, as well as the "CP" range program occupied the attention of the sales section, headed by George B. Johnson, Minneapolis, Minn.

Problems of utility accounting, billing procedures, budget plans for house heating, and insurance coverage were all considered and discussed in the meetings of the accounting section, chairmaned by L. M. Spence of Council Bluffs, Iowa.

For the new fiscal year of the association the following officers were elected on the opening day: E. C. Deane, Sioux Falls, S. D., president; E. J. Otterbein, Davenport, Iowa, 1st vice-president; Arnold Rathkey, Waterloo, Iowa, 2nd vice-president, and R. B. Searing, Sioux City, Iowa, secretary-treasurer reelected after many years of service in that capacity.

A well attended and highly successful banquet and entertainment on the second evening marked the high point of the social side of the meeting, with Ed Otterbein acting as toastmaster.

New York-New Jersey Sales Conference Held

THE annual New York-New Jersey Regional Gas Sales Conference sponsored by the Residential Gas Section of the American Gas Association was held April 11-12 at the Westchester Country Club, Rye, N. Y. The conference featured new angles in sales promotion, presented by outstanding gas company and manufacturer representatives.

J. J. Wholey, Rockland Gas Co., Spring Valley, N. Y., chairman of the conference, arranged the program with the assistance of his committee, comprised of W. D. Williams, Public Service Electric and Gas Co.; W. B. Hewson, The Brooklyn Union Gas Co.; C. A. Kennedy, New York & Richmond Gas Co.; and F. W. Williams, American Gas Association.

The opening speaker April 11 was James W. Carpenter, vice-president, Long Island Lighting Co., Mineola, N. Y., who set the stage with an address on over-all sales objectives of the gas industry. He was followed by speakers covering the water heating, cooking and general appliance manufacturers' fields.

Frank McFerran, Ruud Manufacturing Co., Pittsburgh, made the water heating presentation, entitled "The Big Share of the Business Belongs to Gas." Charles W. Kimball, Cribben and Sexton Co., Chicago, dealt with national cooking trends in an address "Who's Going To Do What To Whom?"

An analysis of the appliance outlook, with emphasis on volume and new features, was presented by Harold Massey, assistant managing director, Gas Appliance Manufacturers Association, New York.

A dinner meeting Thursday evening featured an address by Harry Simmons, sales consultant of New York City, on the topic "Peacetime Challenges to Management."

The Friday program opened with an analysis of financing plans by the chairman of the A.G.A. Appliance Financing Committee, H. W. Nichols, Rochester Gas and Electric Corp. His topic was, "We Must Make It Easy To Buy." Of special timeliness was an address on "What Price Dealer Participation" by H. S. Christman, chairman of the A. G. A. Committee on Dealer Relations and sales manager of The Philadelphia Gas Works Co. He was followed on the program by W. J. Grover, Surface Combustion Corp., Toledo, originator of the "Quick Getaway Plan," who described latest developments in this all-gas merchandising program under the title "Capitalizing on the New Home Market."

Tying the whole program together on a national scale was H. Carl Wolf, managing director, American Gas Association, who concluded the conference with an up-to-the-minute account of the national research and promotional program.

Natural Gas Spring Meeting Scheduled for Cincinnati

The spring meeting of the Natural Gas Department, American Gas Association, will be held May 7 and 8 at the Hotel Gibson in Cincinnati. R. H. Hargrove, chairman of the department and vice president and general manager of United Gas Pipe Line Co., will preside. In addition to the general sessions, there will be special meetings on transmission, production and storage, accounting, technical and research problems and managing and advisory discussions. The program committee is under the direction of W. C. Beckjord, president, Cincinnati Gas and Electric Co.

Nels Swanson To Speak At SCMA Meeting

The May meeting of the Southern California Meter Association will be held at the Rio Hondo Country Club, Downey, Calif., on May 16. Nels Swanson of The Foxboro Co., and formerly in charge of instrumentation at the Goodyear synthetic rubber plant, Torrance, Calif., will present an address, "Mysteries of P.H. How it is Measured, Limitations of Present P.H. Meters, and Information on Installation of P.H. Metering Equipment." Dinner will be served at 6:30, followed by the meeting at 8 P.M.

Corrosion Engineers Meet In Kansas City May 7-9

The annual convention and exhibition of the National Association of Corrosion Engineers is scheduled to take place at the Municipal Auditorium and the Hotel President in Kansas City May 7, 8 and 9. The Gas Industry session will be held at 2 P.M. May 8, with Guy Corfield, research engineer, Southern California Gas Co., as chairman. The program for this session follows:

Guy Corfield

1. The Installation and protection of Underground Gas Distribution Systems With Pipe Line Enamels— P. D. Mellon, Canadian Western Natural Gas, Light, Heat and Power Co., Ltd., Calgary, Alberta, Canada.

2. Magnesium Anodes for the Cathodic Protection of Underground Structures—H. A. Robinson, Dow Chemical Co., Midland, Mich.

3. Use of Fibrous Glass in Underground Pipe Protection—J. A. Grand and S. M. Peek, Owens-Corning Fiberglas Co., Toledo, Ohio.

4. Neutralizing Circuit for Elimination of Long Line Current Corrosion—Wm. R. Schneider, Pacific Gas and Electric Co., Emeryville, Calif.

5. Results Obtained From Five Years of Cathodic Protection on 24-in. Gas Line Rapidly Deteriorating From Bacterial Corrosion—Wm. E. Hudleston, Bartlesville, Okla.

6. A banquet for this group will be held in the main ball room at 7 P.M. with R. A. Brannon presiding.

There will be other sessions during the convention devoted to the chemical, oil and water industries. An electrical and communication symposium will be held, and sessions on the last day will deal with general industry and corrosion activities of technical societies.

NGAA Silver Anniversary Convention Held at Dallas

The silver anniversary convention of the Natural Gasoline Association of America was held April 17-19 at the Baker Hotel in Dallas. Presiding officers were J. H. Dunn, president, and William F. Lowe, secretary. A number of papers and reports on research and new methods were presented during the technical and general sessions of the meeting. An "information please" session was held on the last day, during which executives and technical men had the opportunity of questioning leading authorities on processing, production and operating trends. A panel of experts, divided into sections to cover as many phases of the industry as possible, led the discussions.

Mixed Gas Study Resumed By A.G.A. Laboratories

The American Gas Association Testing Laboratories have undertaken extension of recently completed mixed gas research studies on interchangeability of other fuel gases with natural gases to include manufactured gas as base load. This project is sponsored by the Gas Production Research Committee of which P. T. Dashiell, vice president in charge of production, The Philadelphia Gas Works Co., is chairman, and Edwin L. Hall is secretary coordinator.

The research is under the supervision of a new Technical Advisory Committee on Mixed Gas Research which held its first meeting at the Laboratories in Cleveland on April 2. J. A. Anthes of Brooklyn Union Gas Co. was elected chairman. Attention will be directed to methods and techniques used in gas analyses. Consideration also will be given to the possible use of a test burner or other means for obtaining factors used in the interchangeability equations without necessity of knowing accurately the complete gas analyses.

Charles A. Munroe Award Applications Due Aug. 1

Clifford E. Paige, chairman of the A.G.A. Charles A. Munroe Award Committee and president of The Brooklyn Union Gas Co., has announced that applications for consideration by the Award Committee may be submitted to A.G.A. headquarters until Aug. 1, 1946. The basis of the award, which comprises an engraved certificate and a substantial cash award, is the value of a contribution to the advancement of the gas industry judged on its own merits and without regard to the occupational standing of the candidate. Innovations and improvements brought about through reconversion and post war planning are expected to form the basis for many interesting applications.

Indiana Gas Association To Hold 36th Convention

Some of the addresses to be delivered at the 36th Annual Convention of the Indiana Gas Association, May 9 and 10, French Lick Springs Hotel, French Lick, Ind., will include such topics as Trends in Utility Regulation, Challenges to the Gas Industry, Old Diplomacy and the New Bomb, Automatically Yours, Looking Ahead in Personnel Relations and The Gas Business—Its Future. A large attendance is expected at this convention, which is the first since 1942.

Gas Revenues Gain in Quarter Ended Dec. 31

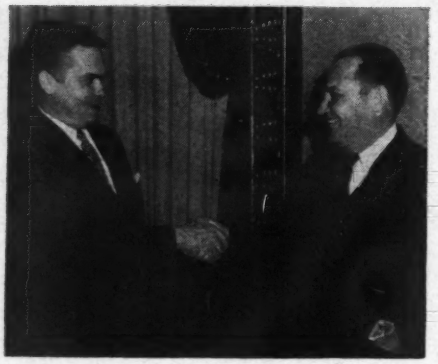
The American Gas Association has reported that total revenues of the gas utility industry in the quarter ended Dec. 31, 1945, were about 289.3 million, an increase of .6% over revenues of $287.5 million in the comparable quarter of 1944. Residential gas revenues were $186.7 million, a gain of 5% over the like quarter in 1944, while industrial gas revenues were $67.1 million, a decrease of 13%.

Value of Injected Gas Is Topic of CNGA

In his talk, "The Investment Value of Injected Gas," M. L. Arnold, Richfield Oil Co. engineer, April 4 told the California Natural Gasoline Association that the existence of opportunities for profit and increased recovery is a challenge to the petroleum industry to reach agreements which will make production under pressure control possible, and to make available the injection gas required.

The Southwestern Gas Measurement Short Course, held April 23-25 at Norman, Oklahoma, was planned by this general committee. Front row, left to right: E. C. McAninch, Oklahoma Natural Gas Co., Ardmore, Okla.; Earl Kightlinger, Arkansas-Louisiana Gas Co., Shreveport; James L. Griffin, Northern Natural Gas Co., Omaha; Miss Kate A. Niblack, Oklahoma Utilities Association, Oklahoma City; R. M. Scofield, Lone Star Gas Co., Dallas; C. A. Gibson, general chairman, Cities Service Gas Co., Bartlesville, Okla.; Dean W. H. Carson, University of Oklahoma, Norman; C. E. Terrell, Southern Natural Gas Co., Birmingham; W. H. Woods, Gulf Oil Corp., Houston. Back row, left to right: J. H. Satterwhite, American Meter Co., Tulsa; W. R. McLaughlin, Pittsburgh Equitable Meter Division, Pittsburgh; Wm. F. Lowe, Natural Gasoline Association of America, Tulsa; W. A. Brewster, Arkansas-Louisiana Gas Co., Shreveport; T. S. Whitis, West Texas Gas Co., Lubbock, Texas; Pat H. Miller, Panhandle Eastern Pipe Line Co., Kansas City, Mo.; E. L. Stark, The Foxboro Co., Dallas; George E. Greiner, Phillips Petroleum Co., Bartlesville; Ben F. Worley, United Gas Corp., Houston.

Oil Compact Discusses Conservation



The importance of research in conservation and development of oil and natural gas was emphasized by Dr. Harold Vagtborg, president, and director of Midwest Research Institute, Kansas City, Mo. (at left), and Dr. E. N. Kemler, head engineering research division, Southern Research Institute, Birmingham, Ala.

ONE of the greatest losses to the oil and gas industry is that of the natural gas which is produced with the oil, Dr. E. N. Kemler, head of the engineering research division of the Southern Research Institute, Birmingham, Ala., told the Interstate Oil Compact Commission, during its quarterly meeting at Tulsa, Okla., April 11-13.

An important conservation possibility is the developing of methods to stabilize the crude in the production so as to retain as much of the solution gases as possible, the speaker asserted. One method is to pipe off the gas to a central pipe line from which it can be processed or marketed. The other is to develop techniques, methods and equipment whereby the gas at each lease or tank battery can be processed.

The speaker also asserted that the proper operation of retrograde condensation wells is likewise important.

Harold Vagtborg, president and director of the Midwest Research Institute, Kansas City, Mo., cited possibilities of vast new developments financially and industrially through chemical conversion of natural gases into various synthetics.

Plastic, tanning, textile, glass and ceramic industries offer great possibilities for expanded use of natural gas in processing operations, the speaker asserted.

A declaration of principles, policy and objectives of the natural gas industry as adopted by the Independent Natural Gas Association of America, was presented to the compact commission by Charles Orr of Oklahoma City, mid-continent secretary of that association. Among these objectives is retention of the democratic principles of private ownership, individual initiative and competitive enterprise, free from government competition or propietorship in any form.

Other objectives include: Promotion of scientific research to continue improvements in the exploration, production, conservation, transportation and utilization of natural gas; providing of more adequate markets for independent producers and royalty owners, maintaining discovery rates, furthering of conservation and making gas more widely available for public use by necessary expansion of lines.

Dealing with governmental matters the declaration seeks to maintain for the states the exclusive function of regulating the production, gathering, and conservation of natural gas and limiting of the jurisdiction of federal agencies to the "reasonable regulation of the interstate transportation of natural gas and its sale in interstate commerce for resale." Safeguarding the benefits of free competition among fuels and prohibiting the regulation of regional or functional end use of natural gas, "either directly or indirectly by any federal agency" is also favored.

Seventeen member states were represented by official delegates at the meeting. Five non-member states were represented by unofficial observers.

The Anglo-American Oil Treaty, now awaiting ratification in the United States Senate, was placed on the agenda for consideration at the summer quarterly meeting of the Interstate Oil Compact Commission in Michigan in August.

CALENDAR

May

American Gas Association Natural Gas Department, Annual Spring Meeting—Hotel Gibson, Cincinnati, May 7-8.

New England Gas Association Appliance Servicing Conference—Worcester, Mass., May 8.

National Association of Corrosion Engineers Annual Meeting—President Hotel, Kansas City, Mo., May 7-9.

Indiana Gas Association, Annual Convention—French Lick Springs Hotel, French Lick, Ind., May 9-10.

Pennsylvania Gas Association—Galen Hall, Wernersville, Pa., May 21-23.

Natural Gas and Petroleum Association of Canada—Windsor, Ontario, May 22-23.

New Jersey Utilities Association Spring Meeting—Seaview Country Club, Absecon, N. J., May 24-25.

June

American Gas Association Joint Production and Chemical Committee Conference — Hotel Pennsylvania, New York City, June 3-5.

National Fire Protection Association—Boston, June 3-6.

American Gas Association Midwest Personnel Conference—Phillips Hotel, Kansas City, June 6.

Gas Appliance Manufacturers Association Annual Meeting — Drake Hotel, Chicago, June 11-12.

Federal Power Commission's Natural Gas Investigation—Washington, D.C., June 17.

Canadian Gas Association, 39th Annual Convention—Mannoir Richelieu Hotel, Murray Bay, Quebec, June 18-21.

American Home Economics Association—Public Auditorium, Cleveland, Ohio, June 24-26.

October

American Gas Association Annual Convention and Exhibit—Atlantic City, N. J., Oct. 7-11.

A new 24-sheet poster was announced for use in the gas industry by R. J. Canniff, advertising and sales promotion manager of Servel Inc., Evansville, Ind. The testimonial in the poster ties in with Servel's national advertising campaign which has recently featured such well-known film stars as Miss Bennett, Jerry Colona and Jane Wyman.

Steam Cooker Being Tested As Part of Gas Range

An innovation in cooking appliances is the Vendo cooker, a low pressure steam oven that is now being tested out in the field preparatory to being placed in production for consumer distribution in 1947. The cooker is designed to be incorporated as an integral part of a gas range, or it can be installed as a self contained gas appliance in the kitchen.

The cooker operates on less than a pound of pressure, with both pressure and temperature of the oven automatically controlled. The oven door has a safety lock, designed to prevent opening of the door when there is steam pressure within.

A gas burner of the standard top burner type supplies the heat for steam which is introduced within the oven from a water reservoir located in the bottom of the unit. The reservoir holds

three quarts of water, sufficient to last three days under ordinary usage. Condensation and drainage from the the oven collect in a pan in the bottom of the unit.

The cooker is designed to be economical of fuel, and to give the advantages of pressure cooking in that vitamins and minerals are retained in the food that ordinarily are lost through open boiling.

The manufacturers advise that the unit is being tested for approval in the A.G.A. laboratory. The range model will be made available to stove manufacturers, and the separate floor model will be distributed through gas appliance retail channels.

Confidental Data Released On Ceramic Coatings

Information concerning compositions and technique of application of ceramic coatings for steel exhaust systems and other high temperature service conditions, which was kept confidential during the war, has been released to about 25 companies by the National Bureau of Standards. One manufacturer sent a set of burners and grates to the Bureau for a trial application of suitable coatings. Two coatings were selected, and several articles finished in each were returned to the manufacturer, who will test them and advise the Bureau of his results. One coating was typical of those used on exhaust systems of military vehicles during the war, and another was finely ground and fired to produce a glossy coating, resembling porcelain enamel, but much thinner and more resistant to thermal shock.

Arkansas-Louisiana Denied Modification of Order

The Fifth Federal Circuit Court of Appeals at New Orleans denied a petition by Arkansas Natural Gas Corp. seeking modification of a Securities and Exchange Commission order of May 5, 1944, requiring the corporation, a large holding company, to divest itself of its subsidiary companies engaged mainly in producing, distributing and selling petroleum and its refined products, retaining only its full ownership of its main subsidiary, Arkansas Louisiana Gas Co. Principal business of the company was described as distribution at retail of natural gas through 103 distribution plants in East Texas, North Louisiana and Arkansas.

Gas Holders Erected at Volta Redonda, Brazil

The first all-welded gas holders built in South America were recently erected at Volta Redonda, Brazil, for the Brazilian National Steel Co., by Stacey Bros. Gas Construction Co., Cincinnati, one of the Dresser Industries. One gas holder has 1 MMcf capacity used for "bubble" on the line. The other, of 5 MMcf capacity, is used for storage of blast furnace gas. Uniform pressure of the amount of gas stored can be maintained at all times because of the piston construction requiring no water tank or multiplicity of holder shells.

Texas Supreme Court Rules Against Tax Collection

The Supreme Court has ruled that the State of Texas may not collect taxes from Southwestern Gas and Electric Co. claimed under the chain store tax law for 1941, 1942 and 1943, because of intent to relieve utility companies from paying the tax when selling gas and electric appliances and parts in towns of 3000 or less. The court also held against the Railroad Commission in its attempt to collect $46,167.55 in gross receipts taxes from United Gas Corp. The law requiring payment of such taxes was repealed, as far as gas distributing companies were concerned, in 1931 the court said.

Panhandle Eastern Proposes Construction Program

Panhandle Eastern Pipeline Co. recently proposed to the FPC a $27,313,000 construction program to extend over a period of two years. The program would enable the company to deliver 90 MMcf of gas daily to markets on its distribution system which now extends from Texas, Oklahoma and Kansas through Missouri, Illinois, Indiana, Ohio and Michigan.

Big Inch Gas, Inc. Offers $40 Million for Pipe Line

The FPC has disclosed that Big Inch Gas, Inc., a new corporation headed by Charles H. Smith, New York, has offered $40 million for the Big Inch Texas to New York line. The company asked authority to operate the 24-in. line as a natural gas carrier, and proposed to spend $30 million on conversion facilities. Another new corporation headed by Smith, Big Inch Oil, Inc., offered to buy the 20-in. Little Big Inch line for transportation of petroleum products.

Trans-Continental Gas Pipe Line Co. previously offered $40 million for both lines and the government's Southwest emergency pipe line, and proposed to spend another $40 million on conversion.

L. M. Glasco of Dallas has proposed to the War Assets Corp. salvaging of the 20-in. pipe in the Little Big Inch line to construct a line from West Texas to California.

Brooklyn Union Employee Champion Meter Reader

George P. Woll, a meter reader employed by The Brooklyn Union Gas Co., recently was acclaimed by his company as the world's champion no-error meter reader.

Woll won the title when on Feb. 26 he took his millionth consecutive perfect reading. It took him a trifle over 12 years to make the million perfect readings. Since Jan. 2, 1931, except for three years he served in the Army, he has been reading meters correctly at the rate of 344 a day or one every 86 seconds.

Fisher Governor Opens New York L-P Gas Office

Fisher Governor Co., Marshalltown, Iowa, has announced the reopening of its liquefied petroleum gas Eastern sales office at 41 East 42nd St., New York 17, N. Y. The office, which was closed during the war because of curtailed production, has an expanded sales force and will handle Fisher LP Gas sales fom Maine to Florida. Walter H. Hoagland has charge of the Eastern office.

Sun Oil Co. Launches Gas Conservation Plan

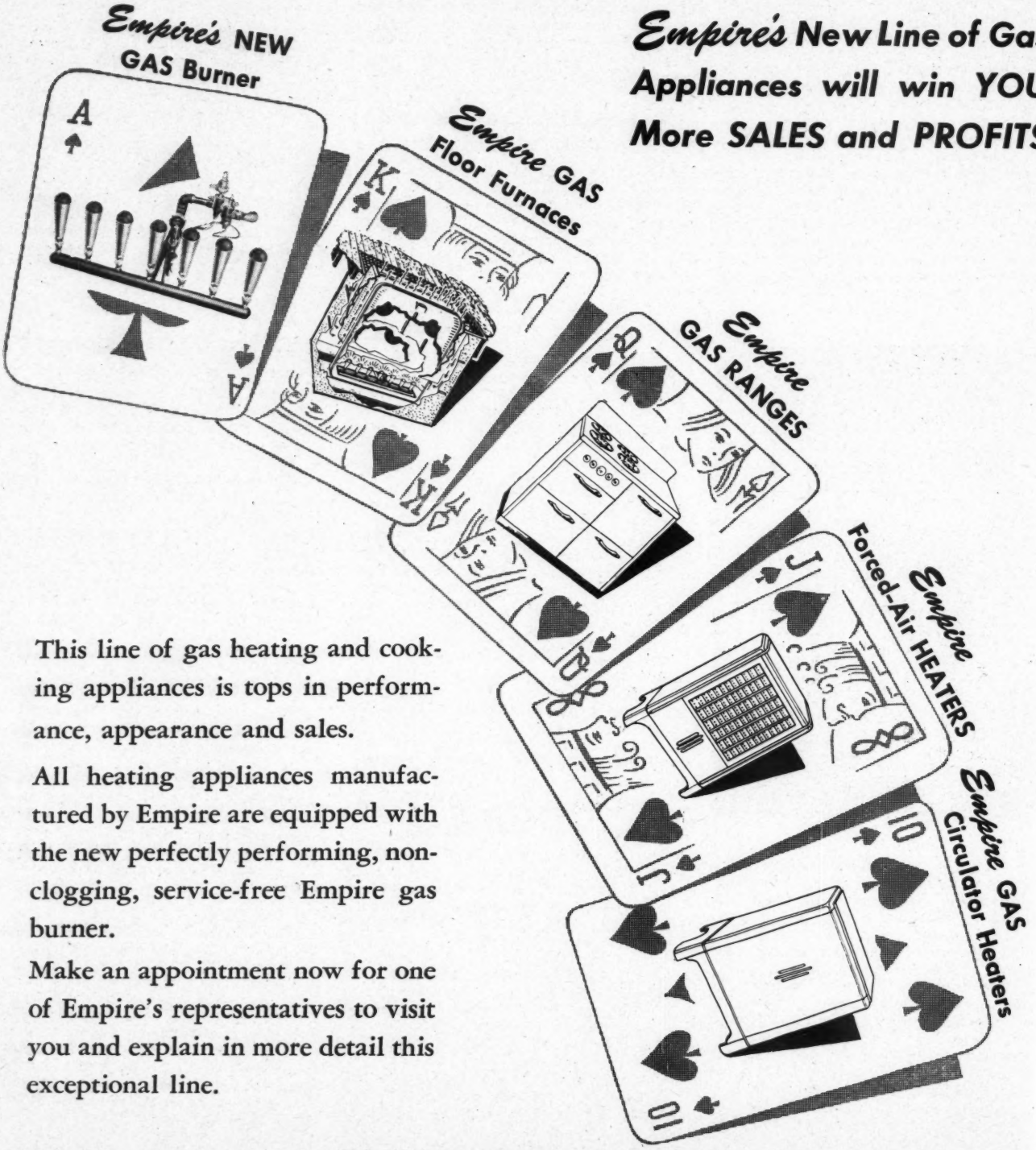
A $4 million program to conserve natural gas has been launched by Sun Oil Co., involving construction of nine processing plants in Texas, Louisiana and Michigan. More than 65 MMcf of gas daily will be conserved. In addition, the company plans to gather and sell from 5 to 6 MMcf daily of waste flare gas in the Beaumont, Texas, area.

Arkansas Power and Light To Serve Nettleton, Ark.

The natural gas division of the Arkansas Power and Light Co., which serves the city of Jonesboro with natural gas, has agreed to extend the line to nearby Nettleton if 85 patrons are secured for domestic or business use of gas. Nettleton residents are securing subscribers and expect to complete arrangements promptly.

A "Royal" Winning Line for You!

Empire's New Line of Gas Appliances will win YOU More SALES and PROFITS



This line of gas heating and cooking appliances is tops in performance, appearance and sales.

All heating appliances manufactured by Empire are equipped with the new perfectly performing, non-clogging, service-free Empire gas burner.

Make an appointment now for one of Empire's representatives to visit you and explain in more detail this exceptional line.

Empire Stove Company

BELLEVILLE, ILL

MANUFACTURERS OF GAS HEATING AND COOKING APPLIANCES

CHICAGO BRIDGE & IRON COMPANY ERECTS

Large Car Type Stress Relieving Furnace

By WILLIAM HELME

Industrial Sales,
The Peoples Gas, Light & Coke Company,
Chicago, Illinois.

LOOKING as "big as all outdoors" on the wind-swept prairie of Chicago's far south side, one of the largest gas-fired car type stress relieving furnaces to be erected in this section of the country was recently put into operation at the plant of the Chicago Bridge & Iron Co.

Designed and constructed by the Rust Furnace Co., Pittsburgh, 178 suppliers of equipment were required to furnish the material necessary for the completion of this project. Excavation work was started early in September, 1945, and the first charge entered the furnace Christmas week.

Externally, the furnace is 97 ft. long, 27½ ft. wide, and 50 ft. 6½ in. high. Inside, the furnace is 85 ft. long by 15 ft. 2 in. wide and 18 ft. 2 in. from car floor to the top of the arch. Over 100,000 bricks were used in the construction of the furnace to form a 13½-in. wall of 2300 degree insulating refractory backed up by magnesium block 1 to 2 in. thick at various points. The furnace is incased in a steel shell. A 36-wheel car topped with fire brick, operating on standard gauge track, hauls the material to be processed into and out of the furnace. When inside, the car fits snugly up against the side of the walls and is sand sealed. The top of the car serves as the bottom of the furnace.

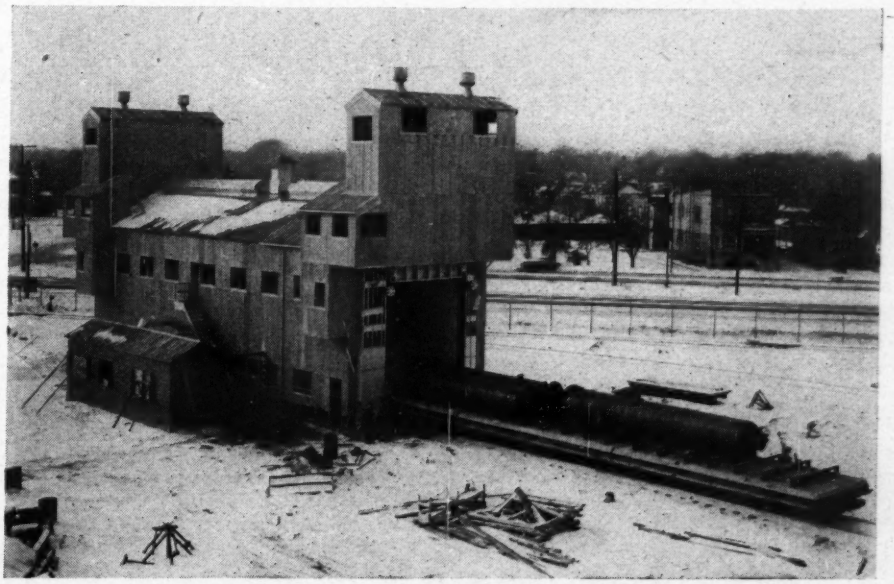
The furnace is fired with 72 McKee entrainment Series "HE" gas burners No. 2-N.H.E., 36 on each side, of which 18 are located to fire between the piers on which the work rests and 18 to fire below the arch. Gas is supplied to these burners by means of a 6-in. service pipe through a low pressure rotary type Connersville meter and Emco regulator which reduces the main pressure from approximately five pounds to six inches of water column. The combustion system is of the conventional type using eight 3-in. Eclipse zero governors. Combustion air is supplied by a Spencer turbine blower having a capacity of 6000 cfm. at 16 oz. pressure, directly connected to a 40-hp. motor. The furnace is equipped with five zones of control which are regulated by five Leeds & Northrup Micromax strip chart type indicating recording and controlling pyrometers. The rated burner capacity is 50 Mcf of 800 Btu mixed gas per hour. Although the furnace is normally operated at a temperature of 1200° F, it is designed to operate at a maximum temperature of 2000° F.

A separate control house adjacent to the furnace provides shelter for the Connersville gas meter, Emco regulator, Spencer turbine blower and Leeds & Northrup temperature control equipment.

The furnace is rated at a gross charge of 360,000 lb. on the car. Vessels or pressure tanks up to 13 ft. 6 in. in diameter by 83 ft. long can be stress relieved in a single heat. There are fire brick lined steel doors at both ends of the furnace weighing eight tons each and operated by 5-hp. motors. Vessels longer than 83 feet are stress relieved in two or three overlapping heats. This is done by allowing a portion of the vessel to extend out one of the door openings and building a temporary closure in its place.

Specifications as laid down by the American Petroleum Institute and the American Society of Mechanical Engineers for unfired pressure vessels to be used for petroleum liquids and gases govern the method to be used in stress relieving. At this plant, the stress relieving treatment usually consists of heating the vessel, tank, or other work to a temperature of about 1200° F and holding it there for an hour per inch of metal thickness. It is then permitted to cool in still air. The ASME code also governs the heating

Interior of furnace showing burner ports top and bottom, also pyrometers on both sides.



View taken from overhead crane showing first charge entering the furnace.

CAR TYPE FURNACE

cycle to be employed and all this, of course, determines the design and construction of the furnace itself.

As the Chicago Bridge & Iron Co. fabricates a large number of propane storage tanks, the ASME code specifies that these pressure vessels be stress relieved and that all of the welded seam be radiographed. A great many refinery towers and drums built in accordance with ASME specifications will also be stress relieved in this furnace. Hortonspheres with cylindrical columns formed from flat steel plates are being built at this plant. These columns are welded directly to the shell of the Hortonsphere. When the columns are welded to the shell plates in the field, there is danger of having locked-up stresses at the connection. As a safety measure, it is necessary to eliminate these stresses and the tops of cylindrical posts for Hortonspheres which have been welded to individual shell plates in the Chicago plant will be stress relieved. In addition, it is planned to stress relieve heavy manways that have been formed cold, and other tank accessories, to eliminate locked-up stresses.

A SUMMARY OF FAVORABLE AND UNFAVORABLE FACTORS RELATING TO THE ELECTRIC, MANUFACTURED AND NATURAL GAS BUSINESS OF THE PUBLIC UTILITY INDUSTRY

Excerpts from a booklet "Utilities—1945" published by Merrill Lynch, Pierce, Fenner and Beane, underwriters and distributors of investment securities, 70 Pine Street, New York 5. This booklet is an analysis for the investor of the electric and gas utility industries, covering such general topics as federal regulation, federal competition, municipal competition, high taxes, and describes briefly the expanding markets which the utilities will have in the immediate years ahead. The booklet also contains an analysis of leading gas and electric companies situated throughout the country.

THE utilities are essential services with expanding markets. Some 80% of the Nation's houses, farms and industrial plants now have electric service and plans are ready to increase this as soon as general business conditions will permit. The wealth of war savings held by the people will be spent in volume on electric appliances from pressing irons to the most modern television receiving sets. There will be more customers and they will use more current—more cubic feet of gas.

There seems to be no danger of exhausting the natural resources upon which these industries depend. The materials needed to manufacture gas are plentiful and easy to get. The natural gas reserves are sufficient to last from 50 to 100 years at normal rates of consumption . . . and that does not include unexplored gas fields. Coal for steam power plants is all but inexhaustible, and water power never wears out.

The industry regards itself as a public service in the best sense of the word and bends every effort to provide improved service at lower costs to the consumer—asks no more than a reasonable return on the invested dollar.

What gas and electric men look forward to is the necessity for shrewdly merchandising their service to the public, and through advertising and public relations affecting, to some extent, governmental policies which apply to the utilities. They also expect a decided increase in the consumption of gas (both natural and manufactured) and electricity not only during the immediate postwar years but for an indefinite period thereafter.

ELECTRIC

Favorable Factors

1. Stability of operation, reflecting the essential character of the service in homes and commerce.
2. The long term uptrend in electric consumption.
3. The non-competitive character of the industry from a territorial point of view.
4. The debt burden well within the industry's ability to carry, financed at relatively low interest rates.
5. The increasingly conservative accounting practices of the industry and the elimination of many write-ups and other inflationary items from plant accounts.

Unfavorable Factors

1. The steady advance in operating costs, particularly wages and fuel prices, and the constant rise in taxes which now consume, on the average, approximately 25 cents of each $1.00 of gross revenues.
2. Repressive governmental policies, such as subsidized public ownership and big public power projects that create in some areas a power supply far in excess of current, normal requirements.
3. Efforts by the Federal Power Commission to encroach upon state regulation of electric companies.
4. Present indications that after the war the downward course of residential and commercial rates will be resumed so that revenue and earnings trends will not fully parallel anticipated operating expansion.
5. The growing tendency to regulate earnings of public utilities on the basis of historical costs in a period of rising prices.

NATURAL GAS

1. High heat content of the fuel which has opened wide and expanding markets.
2. Relatively fixed costs and reserves, in most instances, ample for many years of service.

1. Increasing regulatory pressure designed to limit the rate of return and, perhaps ultimately to determine the specific purposes for which the fuel may be used.
2. Dependence of some pipe line companies on a fluctuating industrial load.

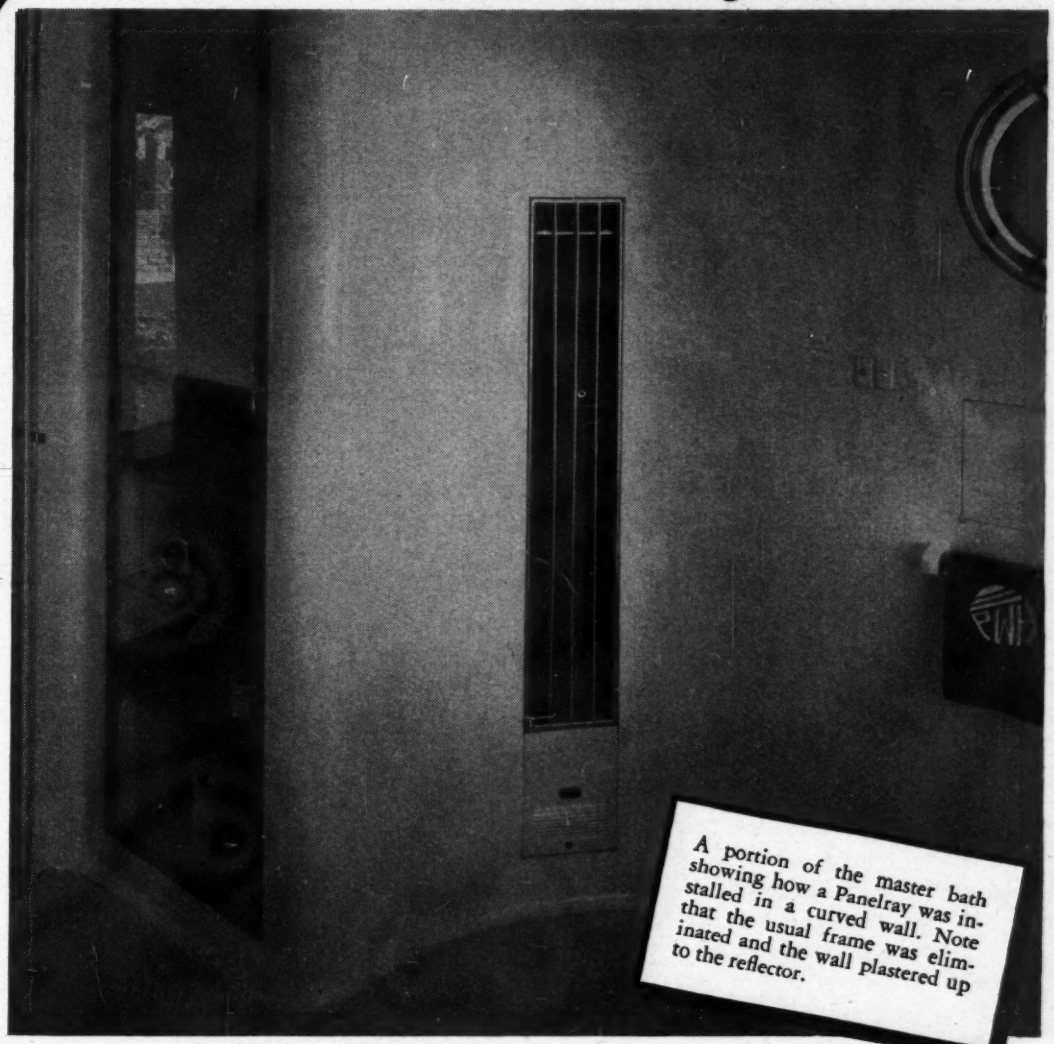
MANUFACTURED GAS

1. Stability of the predominant residential and commercial load.
2. Absence of severe regulatory pressure against the industry generally in recent years.

1. Limited new markets retard growth possibilities and much of present volumes, such as refrigeration, water heating and househeating, is keenly competitive.
2. Inability to exercise close control over costs—particularly wages and fuel despite some offset in by-product coke and chemical sales.

4 DAY & NIGHT PRODUCTS IN BURNS POST WAR HOME

Day & Night Well Represented in World's Most Outstanding Model Home



A portion of the master bath showing how a Panelray was installed in a curved wall. Note that the usual frame was eliminated and the wall plastered up to the reflector.

THE Fritz B. Burns Post War Home, Los Angeles, representing the ultimate in design, construction and home equipment, is attracting nationwide interest. Life Magazine, House Beautiful, and many other national magazines are devoting pages showing interior and exterior photographs, many in full color.

Joseph Schulte, research director for Fritz B. Burns, traveled throughout the United States to find the newest and latest improvements in practical home appliances and equipment. It is significant, therefore, that Day & Night Panelray infra-red heaters were chosen for quick space heating in the two bath rooms and Day & Night water heaters were selected for dependable hot water service in the two areas of hot water usage.

DAY & NIGHT MANUFACTURING CO.

MONROVIA CALIFORNIA

One of the Dresser Industries

WHEN WINTER COMES...

What about your small-town distribution system?

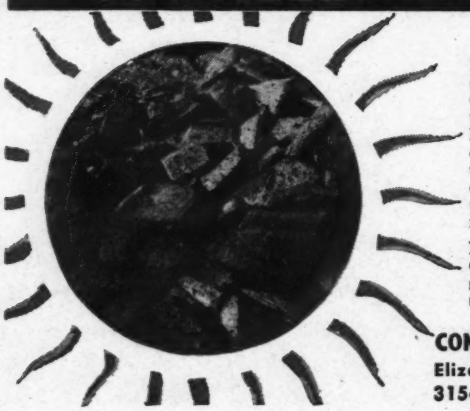
The application of Liquefied Petroleum Gas is the solution of your production, performance and profit problems for small-city gas distribution systems. Warren, one of the nation's oldest, largest and most dependable manufacturers and marketers of Butane and Propane can supply your needs; help you with your engineering and conversion program.

Warren's network of modern production, storage and transportation facilities is available to serve the utility gas industry which finds it desirable, if not necessary, to take advantage of: 1. comparatively low plant conversion cost; 2. materially reduced operating and maintenance cost, through reduction of labor, equipment cost and repairs.

Convert now to a Liquefied Petroleum Gas plant which will operate automatically and insure adequate supply of uniform high quality regardless of the heavy winter load. And take advantage of the broad experience, engineering advice and consulting service of Warren's trained organization without obligation.

WARREN PETROLEUM CORPORATION
TULSA, OKLAHOMA
Detroit Mobile Houston

CONNELLY IRON SPONGE



High in efficiency . . . low in cost. In hundreds of plants throughout the country, Connelly Iron Sponge has proven itself . . . the finest purification material on the market. Not only does it lower your purifying cost but its high activity and capacity tends to reduce distribution and service complaints because of the cleaner gas which ultimately lowers operating and maintenance costs.

If you have a problem in gas purification, Connelly's 68 years of experience is at your service. Our engineers can help you . . there is no obligation on your part.

CONNELLY IRON SPONGE & GOVERNOR CO.
Elizabeth, N. J. Los Angeles, Calif.
3154 S. California Ave., Chicago 8, Illinois

SALES SHORTS

• **American Radiator & Standard Sanitary Corp.**, Pittsburgh, is planning an extensive national advertising program for 1946 according to H. L. Spindler, manager of advertising and sales promotion. The advertising will be highlighted by the new Mark of Merit, a symbol displayed on products in the American-Standard line. The Mark of Merit represents the sun and water, the sun symbolizing warmth and representing heating, and the waves suggesting water and representing plumbing.

Spindler said the objective is to give the public one visual symbol by which they can identify everything made by American-Standard. The theme to be featured in the advertising program will be "Serving the Nation's Health and Comfort."

• **Kalamazoo Stove and Furnace Co.** is planning a program to franchise more than 500 independent dealers—small businessmen who wish to enter the home appliance field. The line will include ranges, washing machines, refrigerators, heaters and furnaces.

Arthur L. Blakeslee, president, says that Kalamazoo has no desire to direct the management of its franchise stores, but will offer a complete business counsel service with special traveling staffs to train salesmen right in the store if the dealer desires. It will require as little as $2000 in some cases to establish an independent dealership under the new program.

• A Tappan gas range was one of the 16 prizes, including other leading brand name products, recently awarded on the "Truth or Consequences" radio program heard over the NBC network. The Tappan, selected as the ideal cooking range, was won by Ensign Richard Batholomew, Fayetteville, Ark., who requested the range be sent to his mother.

• **Coroaire Heater Corp.**, Cleveland, maker of winter air-conditioning units, has set the wheels in motion for manufacture in the British Isles, according to A. W. Conley, vice president. John T. Blossom, representative, has taken a 300-lb. Coroaire space heater to London for use in demonstrations.

• **Bruce & Company** has just signed a franchise with the **American Central Manufacturing Corp.**, to distribute the Connersville, Ind., company's all-steel kitchen sinks and cabinets in the territory of Hawaii, according to C. Fred Hastings, general sales manager.

• Delivered appliance sales for February by the **Brooklyn Union Gas Co.** were the highest ever experienced in that month, amounting to $294,711 or nearly $116,000 above the previous February record established in 1942.

• "The History of Cooking" is a new educational booklet produced by the **American Stove Co.** and available to schools, home service departments, retail training meetings, etc. The booklet, which includes 52 illustrations, tells the evolution of the American kitchen.

You take no chances

with

UNIVERSAL GAS RANGE

YESTERDAY—TODAY—
TOMORROW—THE LEADER:
UNIVERSAL GAS RANGES!

For three generations Universal Gas Ranges have been the standard of perfection. And today Universal offers the most dependable, satisfactory and attractive line of gas ranges in history.

With millions of homes, old and new, to be equipped with new gas ranges, it is important that you present to this new market a range of Universal's proven quality.

1946
Still the UNIVERSAL Selection of Cooking Perfection

CRIBBEN & SEXTON
UNIVERSAL *Gas* RANGE
700 N. SACRAMENTO BLVD. CHICAGO 12, ILLINOIS

NEW PRODUCTS

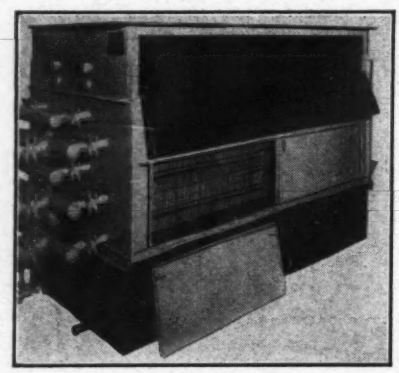
Liquid Cooler

Niagara Blower Co., 6 E. 45th St., New York 17, N. Y.

Model: Niagara Industrial Liquid Cooler.

Application: Furnishes refrigerated cooling water for industrial uses, especially air conditioning or water cooling jackets; for chemical, photographic and industrial processes; or as used in milk plants, bakeries and other food industries.

Description: The cooling water is sprayed over banks of coils in which the



refrigerant is expanded. The water falls into a tank and is recirculated independently of the distributing system, thereby gaining the closest control over temperatures and efficiency in heat transfer regardless of intermittent cooling or variations in cooling load. The capacity in different sizes runs from 4.7 to 137 tons refrigeration. Water deliveries range from 11 to 220 gal. per min. All parts are accessible for cleaning, and Niagara states that coils stay clean indefiitely regardless of water source if the tank is cleaned weekly.

Flame Failure Safeguard

Combustion Control Corp., 77 Broadway, Cambridge 42, Mass.

Model: Fireye Flame Failure Safeguard.

Application: Provides explosion protection for all industrial and commercial oil and pulverized coal burners, cutting off fuel and sounding an alarm when flame fails.

Description: Fireye is photoelectric and is actuated by the flame itself. Type F18T consists of a phototube and amplifying system, housed in a dust-tight aluminum case. The entire control is mounted directly on the furnace wall and alligned so the photoelectric cell may observe the flame through a 2-in. pipe connection which serves as both a sighting tube and a support for the equipment. A clear pyrex filter keeps the equipment dust tight and is mounted on a hinged shutter which can be cleaned without shut-down. The specially designed Fireye phototube permits operation at high ambient temperature.

Mild Steel Electrode

Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y.

Model: Airco No. 312 Electrode

Application: Designed to prevent underbead cracking in the welding of hardenable steels. Satisfactory for welding low alloy, high tensile steels; free machining steels which run quite high in sulphur; cold-rolled steels where extensive porosity is normally encountered.

Description: For material to be vitreous-enameled after welding, this electrode makes possible production of highly satisfactory enameled surfaces without any preheat treatment prior to the enameling operation.

Radiant Burner Tubes

The Gas Machinery Co., Cleveland, Ohio.

Model: Silicon Carbide Refractory Radiant Burner Tubes.

Application: These tubes are internally gas-fired and are for operation at all temperatures up to 2500° F. Particularly adaptable in the heat treatment of metals that require special atmospheres.

Description: The tubes feature silicon carbide tube sections with mating ball and socket surfaces, ground to a gas tight fit. This construction enables any two adjacent tube sections to have universal angular movement while the mating ball and socket surfaces remain in contact. While the ground ball and socket joints are sufficiently gas tight for most practical purposes, a luting has been developed which becomes plastic at the operating temperature of the furnace and lubricates and seals the joints at all operative temperatures. Prolonged tests have demonstrated the long life of these tubes, even when operated at very high temperatures, thereby decreasing maintenance costs.

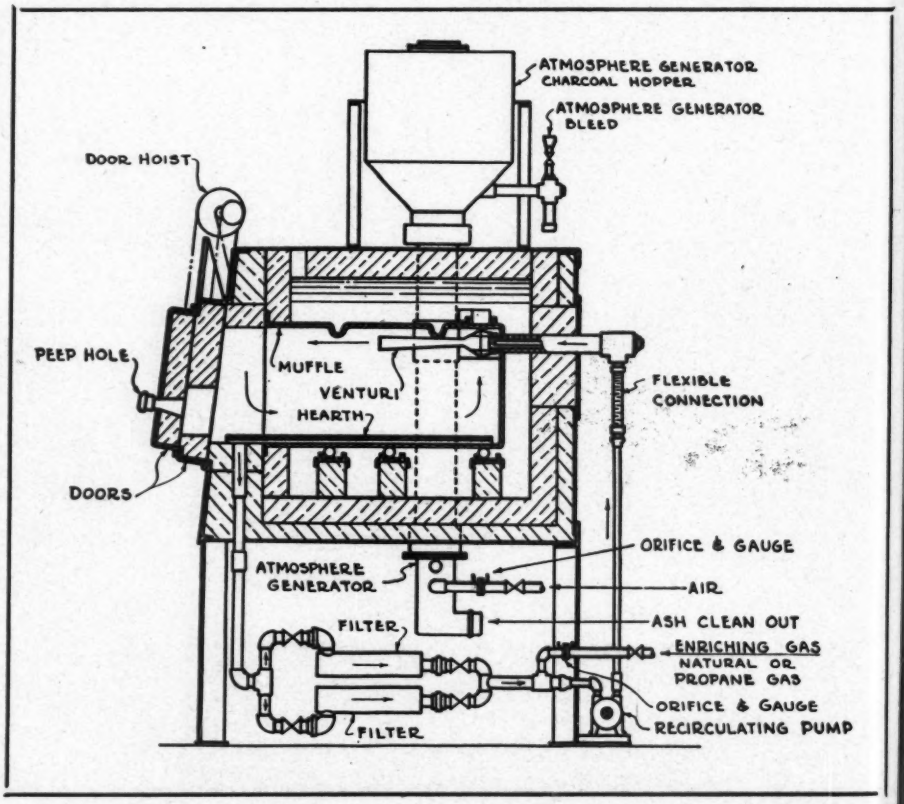
New Carburizing Furnace

Surface Combustion Corp., Toledo 1, Ohio.

Model: Char-Mo Heat Treating Furnace.

Application: Produces the proper atmosphere for gas carburizing, is applicable for general heat treating, and provides atmosphere and uniform temperature distribution.

Description: The basic atmosphere gas for the furnace is made by reacting carbon with air in a generator built into the furnace so that the gas is formed at furnace temperature. After producing this basic atmosphere, the furnace utilizes a new gas enriching and recirculating system for gas carburizing. Filters are at floor level, easily accessible for cleaning. A twin filter unit is supplied, eliminating the necessity of shutting down for filter cleaning. Conversion from a carburizing to a heat-treating atmosphere and vice versa can quickly be made without shutting down. The furnace is available in three sizes for light or medium batch operations.



NATURAL GAS *is now working for you at new* LOW COST!

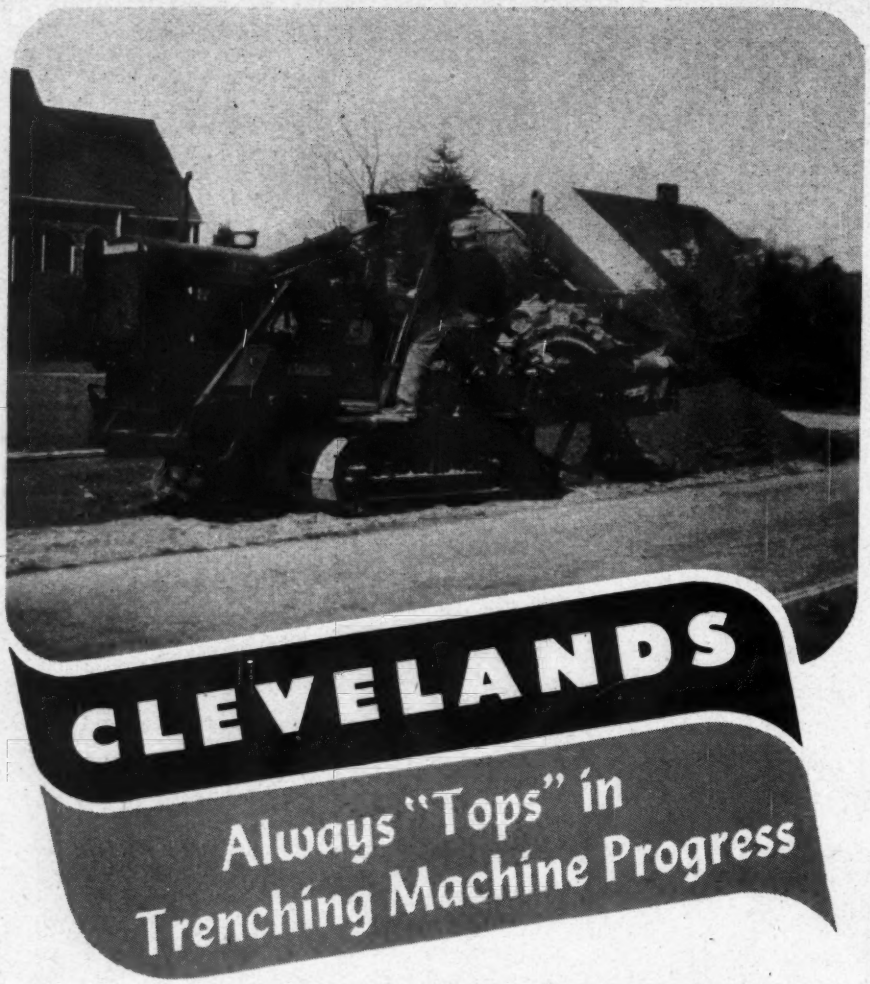
With the new low Natural Gas rates in effect you should plan to modernize or build a new home for the fullest use of gas appliances for modern living. You can put in a larger water heater—of 30 or 40 gallon storage capacity. You can modernize your kitchen with a new automatic Gas Range and a dependable, quiet, carefree Gas Refrigerator. And you can have Gas heat at low cost from a modern, blower-type furnace. You'll be pleased when you learn how little the operating costs of modern gas appliances are under the new, low Natural Gas rates. Come in and ask about average monthly operating costs.

See your dealer or

P·G·and E·

PACIFIC GAS AND ELECTRIC COMPANY

A typical Gas Ad published by the P. G. and E. in Northern California newspapers April, 1946



Cleveland pioneered nearly a quarter century ago, the compact full-crawler mounted digging wheel. Cleveland's continued alertness to customers' requirements plus an aggressive open-minded engineering has contributed such other "firsts" as — transmission controlled speed changes and speed combinations, equalized drive to the digging wheel through enclosed differential, trailer mobility, unit-type construction minimizing repair time — most complete utilization of anti-friction bearings, welded construction of quality materials. THIS IS YOUR GUARANTEE THAT WITH CLEVELANDS ON YOUR JOBS YOU WILL GET "MORE TRENCH IN MORE PLACES AT LESS COST."

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Manufacturers of . . .
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Pasadena 2, Calif. Phone: SYcamore 2-3868

Catalogs

• **Fischer & Porter Co., County Line Road, Hatboro, Pa.**—This company has three new bulletins available. An 8-page composite, 45-A, explains rotameter advantages, styles and uses. For free copy address Dept. 5-4. "Theory of the Rotameter," 98-Y, is available from Dept. 940-A. This is a revised printing and contains changes and brings the subject up to date. Catalog 43-E, "Armored Rotameters for Flow Rate Measurement and Control," describes standard armored indicating meters and recording or totalizing armored meters. It includes illustrations of many designs for pressures as high as 10,000 psi and temperatures up to 750° F. Write Dept. 940537-O.

• **Dow Corning Corp., Midland, Mich.**—"Dow Corning Silicones, New Engineering Materials" is an 11-page catalog listing all of this company's silicone products now available, and containing many charts and graphs demonstrating the properties of these organo-silicon-oxide polymers. A number of special formulations and industrial uses are described. Address inquiries to O. D. Blessing, sales manager.

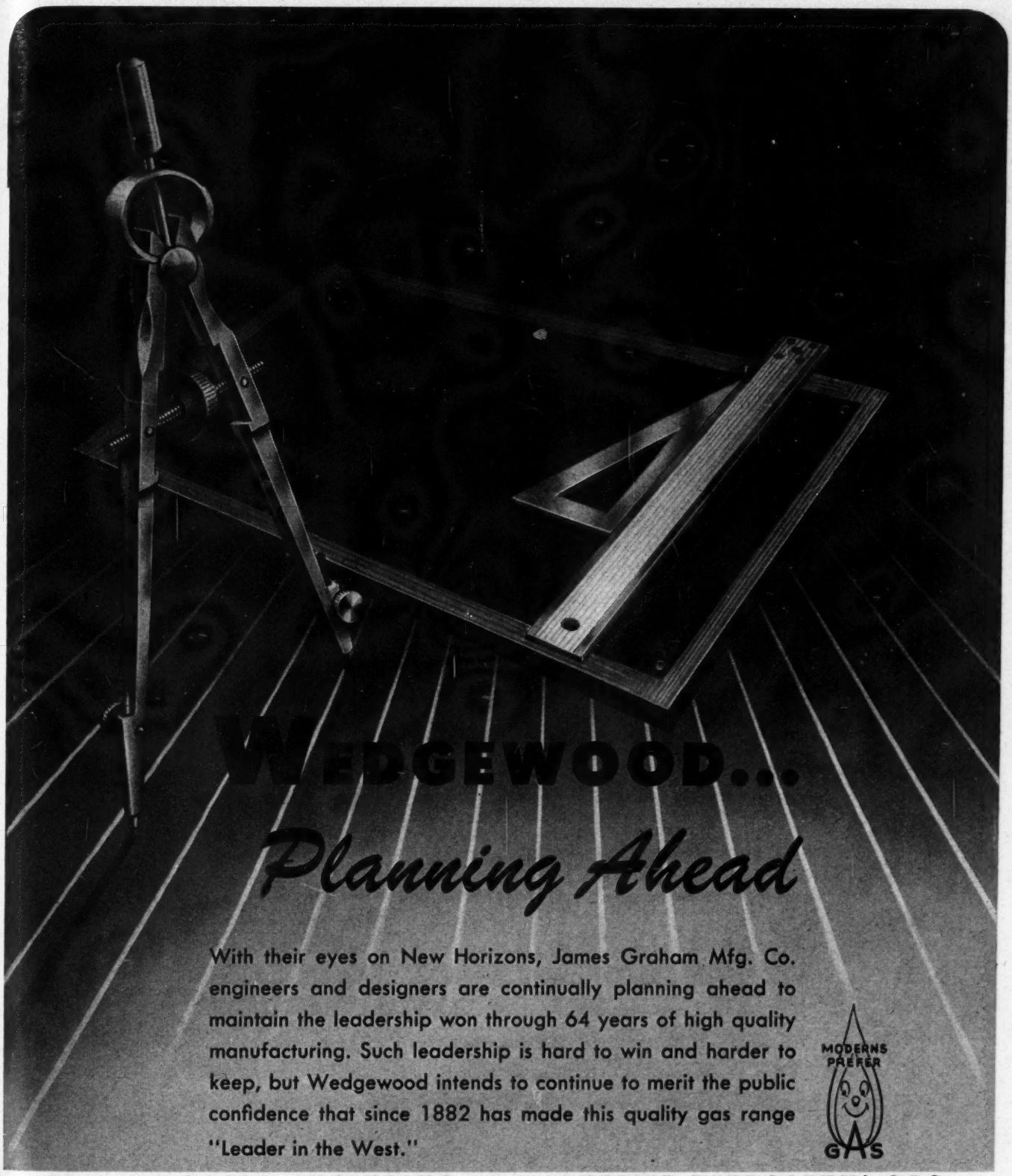
• **Askania Regulator Co., 1603 South Michigan Ave., Chicago 16, Ill.**—"Process Control Terms" is an illustrated dictionary in terms of Askania "hardware" based on process control terms recommended by the Terminology Committee of the American Society of Mechanical Engineers. The 25-page bulletin is an attempt to translate abstract terms and definitions into realistic pictures of actual apparatus.

• **The Foxboro Co., Foxboro, Mass.**—Catalog 370 presents the company's full line of recording and indicating instruments for measurement and control. Profusely illustrated and arranged for quick reference. The Foxboro line of Dynalog electronic instruments, limited to military use until recently, is included for the first time. Free upon request.

• **A. M. Byers Co., Pittsburgh, Pa.**—"Wrought Iron for Radiant Heating" is a 52-page catalog containing engineering information and data on installations of radiant heating systems here and abroad. There is a complete discussion of the principles of radiant heating, with charts and graphs.

• **Victor Equipment Co., 844-54 Folsom St., San Francisco**—The 1946 50-page welding supply catalog covers a large assortment of supplies required for gas or electric welding and flame cutting. It is complete with sizes, prices and shipping information on every item. Illustrated. Free upon request.

• **The Fluor Corp., Ltd., 2500 S. Atlantic Blvd., Los Angeles 22, Calif.**—Fluor's Aerator Cooling Tower Bulletin has been printed in Spanish. It is completely illustrated with tables, charts and photographs. Write J. F. Gardner, advertising director.


WEDGEWOOD...
Planning Ahead
With their eyes on New Horizons, James Graham Mfg. Co. engineers and designers are continually planning ahead to maintain the leadership won through 64 years of high quality manufacturing. Such leadership is hard to win and harder to keep, but Wedgewood intends to continue to merit the public confidence that since 1882 has made this quality gas range "Leader in the West."
MODERNS PREFER
GAS
FOR ALL GASES, INCLUDING LP (LIQUEFIED PETROLEUM) GAS

PEOPLE

• **William H. Zimmer** and **Fred R. Rauch** are newly-elected vice presidents of The Cincinnati Gas & Electric Co. Both men will continue in their present positions—Zimmer as treasurer and Rauch as director of industrial relations. **Allen Strunk** has succeeded Zimmer as assistant secretary of the company.

F. R. Rauch

Zimmer has been with the company since 1920. He has risen through the ranks and was elected to the board of directors in September, 1943. Rauch joined CG&E in 1942 after serving the federal government for eight years in engineering, labor relations and executive positions. He is chairman of the Industrial Relations Committee of the American Gas Association.

• **Alfred Hirsh,** vice president, Laclede Gas Co., St. Louis, has announced that on April 1 **George D. Dodd,** superintendent of streets; and **Dyke Wilson,** chief chemist, retired. **C. E. Schoene** has been appointed superintendent of streets to succeed Dodd; **Joseph Kohlberg,** assistant chief chemist, will succeed Wilson; and **Herman Gieselman** will replace Schoene as head of the department of design and records.

• **C. L. Hewitt, Jr.,** has been appointed manager of sales for the heating equipment division of Rheem Manufacturing Co. it has been announced by **Frank J. Nugent,** general manager of sales, appliance division. For more than 20 years Hewitt was with L. J. Mueller Furnace Co. of Milwaukee, in Baltimore, with whom he became eastern sales manager. He will make his new headquarters in Chicago.

• **Marion Wasson,** former acting business manager of the University of Arkansas and bank commissioner, has been elected vice president of the Arkansas Western Gas Co., **L. L. Baxter,** president, has announced. Wasson has been secretary-treasurer of the company. **Joe Krumpler** was elected treasurer and **Charles F. Brannen,** secretary, at a recent directors' meeting.

• **Richard S. Sawyer** has been named assistant general manager of purchasing and traffic for Rheem Manufacturing Co. and will make his headquarters in the New York office, according to an announcement by **Clifford R. Hale,** general manager of purchasing and traffic.

• **C. L. Torrence** was recently appointed eastern manager of Philgas Retail Division, Phillips Petroleum Co. He joined Philgas in 1937.

• The appointment of three industrial specialists as representatives of Bryant Heater Co.'s industrial division is announced by **D. A. Campbell,** manager. **Lawrence R. Foote** will be located in New York, **Oliver Stirling, Jr.,** will represent the division in Michigan and part of Ohio with headquarters in Detroit; and **Carl Mansfield,** who has been with the Detroit ordnance district, will be associated with Stirling.

• **Walter E. Bolte,** assistant vice president of Brooklyn Union Gas Co., has received the War Department's Commendation for Exceptional Civilian Service, highest award the Army can give to a civilian. The award was presented for his services during the war as chief of the fuel and heating unit in the office of the chief of engineers.

• **General Brehon B. Somervell,** commander of Army service forces during the war, was elected president of Koppers Co., Inc., by the board of directors it was recently announced by **J. P. Williams, Jr.,** chairman of the board. Somervell assumed his new duties in Pittsburgh about May 1.

• **Irwin A. Rose** was recently elected as vice president in charge of manufacturing of The Maytag Co., Newton, Iowa. Rose held a similar position for the past four years with the Edison General Electric Appliance Co., Inc., Chicago. He had been with the GE subsidiary in Chicago for 23 years, serving in various capacities.

I. A. Rose

Rose is taking over a post at Maytag formerly held by **A. H. Taylor** who resigned last September. In the meantime, the duties of manufacturing executive have been handled by **Fred Maytag II,** third generation president of the concern.

• **P. A. Alers** has been appointed manager of the El Paso, Texas, office of Worthington Pump and Machinery Corp. **Andrew S. Ormsby,** formerly in charge of industrial relations of the Bendix Aviation Co., is the new director of industrial relations.

• **Arne Eriksen** has been appointed western representative of both the gas processes division and the votator division of the Girdler Corp., with headquarters in San Francisco.

• After almost four years in the Navy, **R. D. Price** has returned to his old position as assistant to the personnel director, Louisiana Power & Light Co.

• **D. W. Reeves,** formerly industrial sales manager, Oklahoma Natural Gas Co., Tulsa, has been promoted to the position of general sales manager, **Joseph Bowes,** president, announced He succeeds **J. H. Warden,** who recently resigned to become president of the West Gas Improvement Co., New York.

D. W. Reeves

Reeves has headed the Industrial Sales Department since 1938. In July, 1942, he was given a military leave of absence to accept a commission in the Army. He was discharged and returned to the Oklahoma Natural Gas Co. Feb. 1, 1946.

Before joining Oklahoma Natural in 1938, Reeves spent 13 years in utility sales work with the Louisiana Electric Co. and the Gulf States Utilities Co.

• The M. W. Kellogg Co. of Jersey City and New York City, elected the following officers at a recent meeting of the board of directors: **M. W. Kellogg,** chairman of the board; **H. R. Austin,** president; **F. E. Johnson,** vice chairman of the board; and **L. H. Harvison,** executive vice president. The new positions of chairman and vice chairman of the board were necessitated by the company's proposed expansion program.

• **John H. Warden,** general sales manager, Oklahoma Natural Gas Co., Tulsa, has resigned to become president of the West Gas Improvement Co., 90 Broad St., New York, N. Y., according to an announcement by **Joseph Bowes,** president, Oklahoma Natural. The company Warden will head is a Stone & Webster subsidiary.

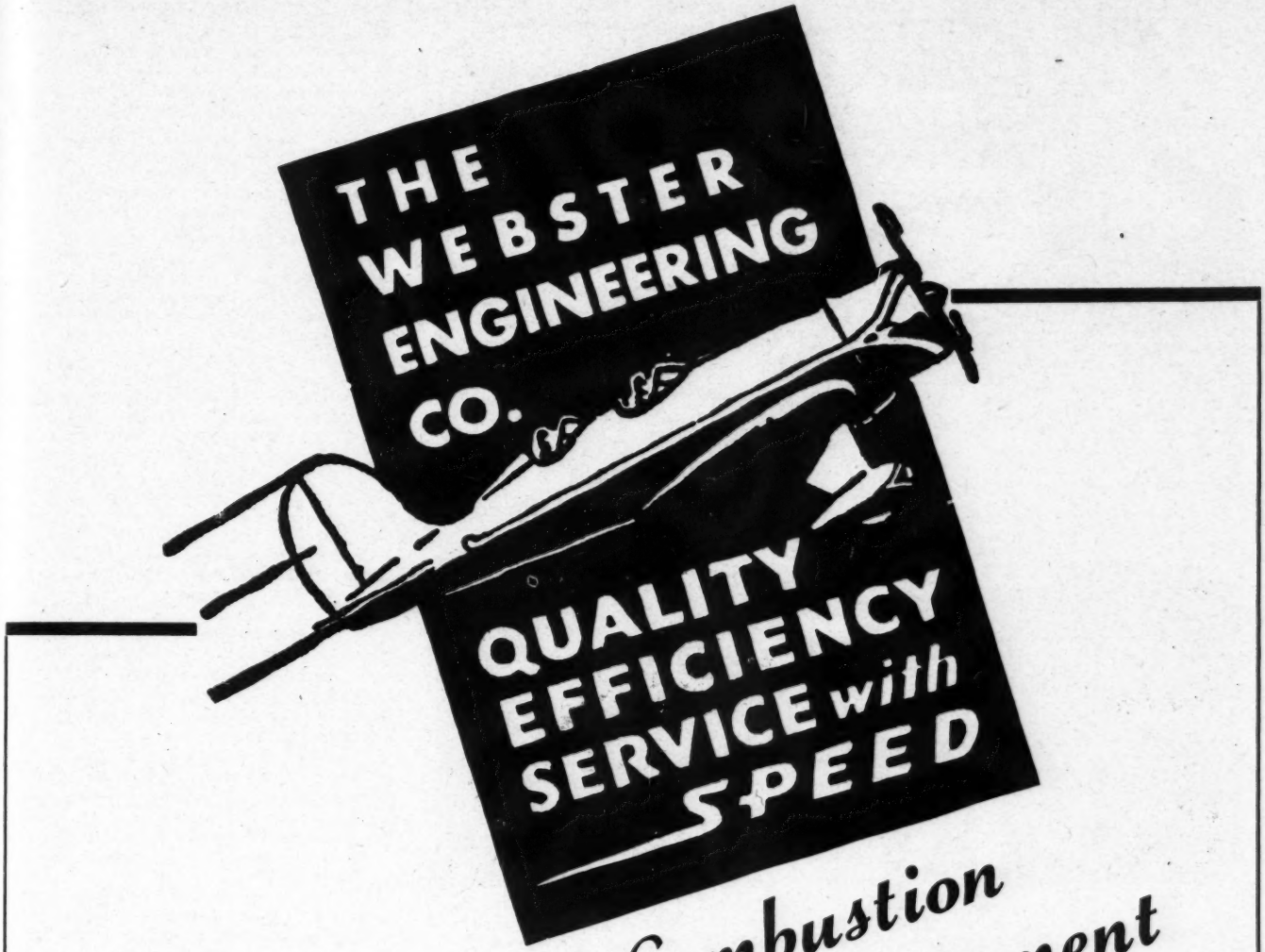
• The election of **A. B. Cameron** as vice president and sales manager has been announced by **James Mitchell,** president of Grand Home Appliance Co. of Cleveland. Cameron will supervise a major expansion program in the company's production facilities.

• **William E. Thomas** has been appointed division sales manager of Homestead Valve Manufacturing Co., Coraopolis, Pa. He will be in charge of valve sales in the Southeastern states with headquarters in Atlanta.

• **Howard Waddle** of Magnolia, Ark., who has been construction engineer of the McKamie Gas Cleaning Co., Magnolia, since 1941, has been named by the board of directors as manager to succeed the late **Roger A. Howe.**

• New personnel director of San Diego Gas & Electric Co. is **Howard Braxton Rountree.** He succeeds **Ray Edwards,** who has been transferred to another position.

• **Layton Lansing** is the new resident manager of the eastern division's Glens Falls district of Niagara Hudson Power Corp. He succeeds **E. J. West, Jr.**



Gas Combustion and Control Equipment

Webster Combustion Engineers are ready to assist in solving your combustion problems—to furnish standard designed and manufactured burners and controls and to design special equipment to meet special conditions.

Consult Webster First—

THE WEBSTER ENGINEERING COMPANY . . . Tulsa, Okla.

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Representatives— CATLETT ENGINEERS, Inc., Dallas • F. J. EVANS ENGINEERING CO., Birmingham, Houston
F. P. FISCHER ENGINEERING CO., New Orleans • E. G. LANGHAMMER CO., San Antonio
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ECONOMY EQUIPMENT CO., Kansas City, Kan., & St. Louis • FEDERAL SUPPLY CO., Oklahoma City
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● Non-metallic Transite Flue Pipe not only is rustproof, it is light in weight . . . easy to install and support . . . can be cut to fit on the job. Neat and attractive in appearance, it needs no painting. 2" to 12" sizes; round and oval. Complete line of fittings and accessories.

For details, write for booklet TR-13A. Johns-Manville, 22 East 40th Street, New York 16, N. Y.

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Johns-Manville **TRANSITE FLUE PIPE** For venting gas-burning appliances

SEMET-SOLVAY ENGINEERING CORPORATION

Blue Gas Plants	Gas Purifiers
Water Gas Machines	Condensers
Washer Coolers	Waste Heat Boilers
Naphthalene Scrubbers	Producer Gas Plants

40 RECTOR STREET, NEW YORK, N. Y.

● **Edward A. Holmberg** has been made manager of the Appliance Promotion Bureau of Consolidated Edison Co. of New York, Inc., according to an announcement by **Ephraim F. Jeffe,** vice president in charge of sales. Holmberg takes the place formerly held by **Dennis S. Melvin** who has been transferred to the purchasing department as the result of his selection for the company's Executive Development Program.

Harry A. Sammond, formerly associate district sales manager, has been named assistant to Holmberg. **Thomas J. Collins** has been made manager of the showroom division of the Bureau, in charge of showroom activities in 26 company locations throughout the service area. **Edward D. McOwan** has been taken into the sales department as assistant manager of the dealer division of the Appliance Promotion Bureau. **Miss Marion Seitz,** formerly secretary to the chairman of the executive committee, has been named assistant manager of the home service division of the bureau to assist **Miss Lucy L. Hanan,** in organizing the division's program of lecture demonstrations to consumers.

● **C. J. McNamara,** president, has announced that **Roy E. Manning** is the new national sales manager of Pittsburgh Water Heater Co. Manning will be in charge of sales, service, advertising and marketing.

● The appointment of **Arthur Abel** as sales engineer on the staff of its Odessa, Texas, branch is announced by **Stanley E. Johnson,** director of sales of The Cooper-Bessemer Corp., Mount Vernon, Ohio.

● **W. S. (Sim) Jones** has joined the sales organization of Caloric Gas Stove Works and is representing the company throughout the entire State of Michigan. The announcement was made by **Julius Klein,** general sales director of Caloric Gas Stove Works.

● **J. S. Stevenson** recently assumed his new duties as head of the stores department of Panhandle Easern Pipe Line Co. Stevenson will headquarter in Kasas City.

Obituaries

● **Roger A. Howe,** 55, vice president and general manager of the McKamie Gas Cleaning Co., Magnolia, Ark., died March 11 in a Magnolia hospital following a heart attack. He was born in Canton, Ohio, and was reared in Finley, Ohio. Howe was an executive of the Standard Oil Co., Shreveport, from 1911 to 1942, when he became general manager of the sour gas cleaning firm.

● **Roy B. Mason,** superintendent of transportation, Kansas City Gas Co., was found dead near his home in Kansas City on March 2. A heart attack is believed to have caused his death. Mason had been employed by the company since March 1, 1915.

● **Ross Cook,** 41, Kermit district manager of Community Public Service Co., died very suddenly on March 18. He had been with the company since 1932.

Every Dealer is a BOOSTER

Ward dealers are enthusiastic about Ward Floor Furnaces! They know from experience these two things:

1. *Ward has well-established customer acceptance. In every area where it is sold it is considered the standard of quality among floor furnaces—the furnace that is recommended by one home owner to another.*

2. *Ward delivers efficient, trouble-free performance. Result: no "comebacks" or complaints.*

The Ward Floor Furnace of today is the result of 37 years' experience in building floor furnaces. *We build floor furnaces exclusively* and can concentrate our entire engineering and manufacturing resources on this one product.

At the present time, we are able to fill only a fraction of the orders received. Our present dealers must come first. However, we are looking forward to the day when we will be able to offer additional dealers the sales advantages of Ward Floor Furnaces.

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37 YEARS OF "KNOW-HOW"

WARD HEATER COMPANY

1800 W. Washington Blvd., Los Angeles 7, Calif.

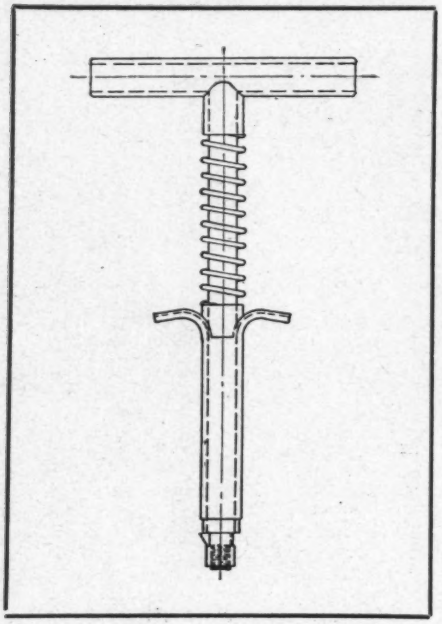
WARD
FLOOR FURNACES

OPERATING IDEAS

Tool For Cutting Burrs From Meter Run Taps

H. RAY TAYLOR, Cities Service Gas Co. Presented before the 1945 Wrinkle Class, Southwestern Gas Measurement Short Course, conducted by ROY S. PEACE, Jr., Southern Natural Gas Co.

This tool consists of a stem fitted with a T-handle, a cutting tool at opposite end and a sliding sleeve held in place by a spring.



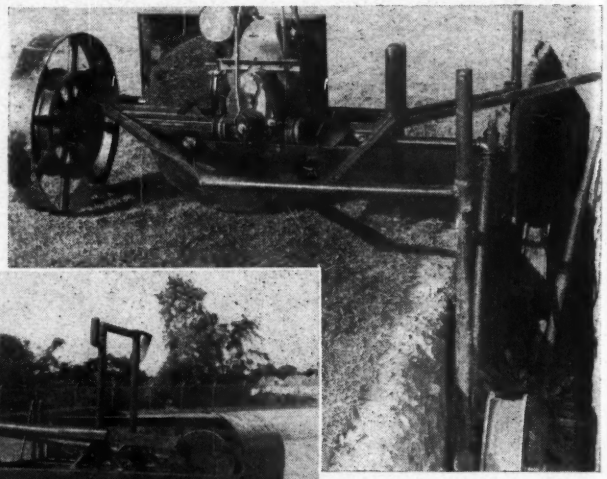
To use the tool the spring is compressed and the cutting tool inserted in the drill hole. The spring is then released, pulling the cutting tool against the pipe. Turn the stem one turn and the job is done.

Pipe Cleaning Devices

Brush and scraper developed and used by Michigan Consolidated Gas Co., Detroit, for cleaning pipe.

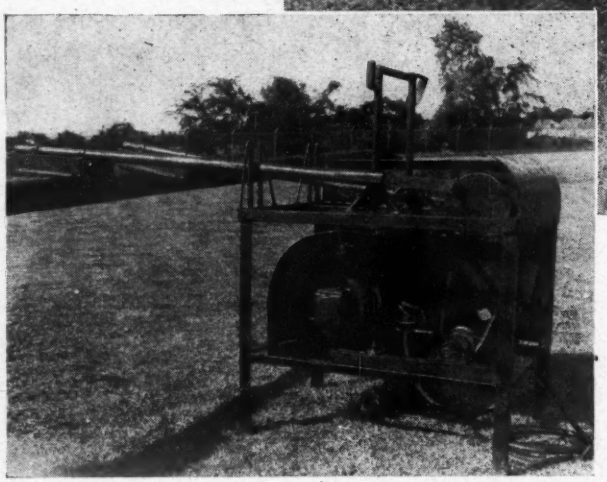
Brush Unit—This unit is used for brushing pipe in conjunction with the yard coating operation. The pipe is rotated and pushed under the brushes by the power unit of the coating machine. The purpose of this device is to remove loose rust and scale from the pipe. The cleaning is about equivalent to a hand brushing job with the machine doing the work of three men. The unit is powered with a 2-hp three phase 1750 rpm motor with a double speed reduction through V belts. The brushes operate at 180 strokes per minute.

Scraper Unit—The scraping device in this unit is the Jinnett pipe scraper designed for hand operation. The scraper rocks on the pipe through an arc of approximately 20°. The cutters are arranged so they cover the entire surface of the pipe in their rocking motion. Power is applied to the scraper by a 3-hp gasoline engine connected to the rocker arm through a gear reduction and V-belt drive. The rocker arm makes 60 strokes per minute. This unit follows a flame cleaner, which heats the pipe and thoroughly dries the encrusted materials. The power unit does the work of three men.



(Right)

Scraper Unit.



(Left)

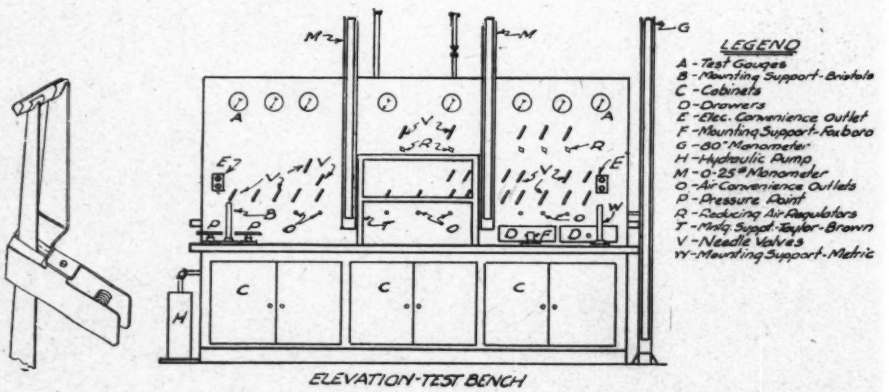
Brush Unit.

Jig for Soldering Pen Through on Pen Arm Developed by Cities Service Gas Company

H. RAY TAYLOR, Cities Service Gas Co. Presented before the 1945 Wrinkle Class, Southwestern Gas Measurement Short Course, conducted by ROY S. PEACE, Jr., Southern Natural Gas Co.

This device is to hold a pen point trough in place while soldering the trough to the pen arm.

After the trough and the end of the pen arm are tinned, the trough is placed in the tool as shown in the cut and the tool snapped on the pen arm with the trough in position for soldering. When the job is completed the trough is at right angles to the pen arm.


LEGEND
A - Test Gauges
B - Mounting Support - Bristols
C - Cabinets
D - Drawers
E - Elec. Convenience Outlet
F - Mounting Support - Fisher
G - 80" Manometer
H - Hydraulic Pump
M - 0-25" Manometer
O - Air Convenience Outlets
P - Pressure Point
R - Reducing Air Regulators
T - Mtdg. Suppt. - Taylor - Brown
V - Needle Valves
W - Mounting Support - Metric

ELEVATION-TEST BENCH

Worth Waiting For...

REMEMBER THIS
MARK OF QUALITY

A HUMPHREY PRODUCT

Although our factory daily is producing more and more fine Humphrey appliances, still there are not enough available to meet the immediate needs of everyone. We are making every effort to satisfy the great demand for these high quality Humphrey products — products of distinction which are well worth waiting for.

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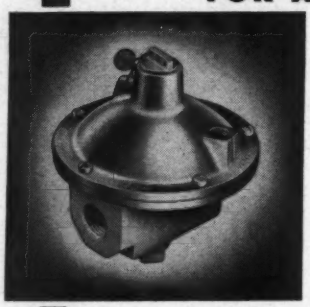
Specify H-M REGULATORS

FOR ALL GAS APPLIANCES



H-M Low Pressure Gas Regulator
Sizes from ⅜ in. to 1½ in.

Here is an all aluminum regulator with corrosion resistant internal parts. Extremely light in weight; easy to handle and inexpensive to ship. The H-M High Capacity Regulator, rugged and sturdy in construction, is known for its long life and practically trouble-free operation.
Designed with excellent flow characteristics at all pressures, the H-M Gas Regulator is produced complete by THERMAC from foundry to final assembly.

Factory Tested and Sealed at Customer's Desired Setting

Every H-M Regulator is factory tested and sealed. Available in size from ⅜ to 1½ inch, this carefully engineered product, approved by A.G.A. is again back in the market. Orders are now being accepted on surprisingly short delivery. Literature and quotations upon request.

THERMAC COMPANY

800 EAST 108 ST. • LOS ANGELES 2, CALIF.

Complete Protection

against Defective Thermostats

with

KITSON EMERGENCY GAS SHUT-OFF VALVE

TYPE
IHF-22
A.G.A.
Certified

Safe gas water heater observation is paramount. The Kitson patented Emergency Gas Shut-off valve acts positively before the water temperature reaches the danger point should the thermostat stick or fail to operate.

APPROVED AND USED BY LEADING GAS COMPANIES. Available in ½" to 1½" I.P. sizes.

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GROUND KEY GAS STOPS
Regular and High Pressure
METER CONNECTIONS

Write for descriptive literature and prices.

KITSON COMPANY
1500 WALNUT ST., PHILA. 2, PA.
A WHOLLY OWNED SUBSIDIARY OF WELSBACH ENGINEERING AND MANAGEMENT CORP.

PIPE LINE NEWS

• The Federal Power Commission has granted authority to the **Kansas-Nebraska Natural Gas Co.**, Phillipsburg, Kan., to construct, acquire and operate gas transportation facilities in Kansas and Nebraska at an estimated cost of $1,575,000. The construction work will be commenced immediately.

The applicant will be able to obtain adequate volumes of gas from the Hugoton Field and discontinue the receipt of gas from the **Kansas Power and Light Co.** Greater delivery capacity will meet increased demands of the company's present customers and supply new markets in Kansas and Nebraska.

The Commission's authorization includes the following:

1. Construction of a new 1000-hp compressor station near Palco, Kan.

2. Installation of a 1000-hp compressor unit and auxiliary equipment at an existing compressor station near Scott City, Kan.

3. Removal of a 500-hp compressor station near Traer, Kan., to the vicinity of Colby, Kan.

4. Removal of three 450-hp units from the Scott City compressor station and their installation at a new compressor station in the Hugoton gas field near Deerfield, Kan.

5. Laying of approximately 56 miles of 16-in. and 21 miles of 12¾ in. pipe line extending from the company's existing pipe line near Phillipsburg, Kan., to a junction with an existing pipe line near Hastings, Nebr.

6. Replacement of approximately 56 miles of 16 in. line extending from a junction with an existing line in Hamilton County, Nebr., and terminating at a point in Thayer County, Neb., with pipe of smaller diameters.

7. Construction of eight lateral pipe lines with an aggregate total of approximately 100 miles to serve a number of Nebraska communities.

In addition, Kansas-Nebraska will acquire from **Central Electric & Gas Co.** about 34 miles of lateral pipe line together with town border meter and regulating stations.

• **The Panhandle Eastern Pipe Line Co.**, Kansas City and Chicago, proposes to make extensive additions during 1946 and 1947 to its main gas transmission system extending from Texas to Michigan, according to an application filed with the Federal Power Commission. Total cost of the constructions is estimated at $27,313,000. The program will enable Panhandle to deliver an additional 90 MMcf of gas per day to markets on its system.

Proposed facilities for 1946 include: (1) A field compressor station in Moore County, Texas, with a capacity of 3000 hp and a dehydration plant. (2) Six additional compressor units of 800 hp to be installed in existing compressor stations. (3) Two 1600-hp compressor units to be installed in each of four compressor stations in Illinois and Indiana. (4) Fifty miles of 18-in. trunk line and 24 miles of 26-in. loop line paralleling existing loop lines in Texas. (5) Compressor cylinder and valve changes on

equipment and piping at the Liberal compressor station, Seward County, Kan.

Construction on another group of proposed facilities will be delayed until 1947.

• **The Mississippi River Fuel Corp.**, St. Louis, April 5, announced plans to provide the St. Louis area with an additional 48 MMcf of natural gas daily, or 41% more gas than has been available. Ben Comfort, president, said all materials have been ordered for the project, including $3.5 million in pipe. He said the project, under application to the FPC, will cost $11.57 million. The additional supply of gas would be sufficient to enable **Laclede Gas Light Co.** to substitute straight natural gas for the mixture of natural and artificial gas now being distributed... In addition to Laclede, Mississippi River Fuel sells gas to **St. Louis County Gas Co., Illinois Power Co., Union Electric Power Co.**, and directly to industries.

• The FPC has postponed indefinitely the hearings set for April 15, on an application of the **Metropolitan Eastern Corp.** for a certificate to construct and operate an 825-mile, 18-in. pipe line extending from the Carthage field in Panola County, Texas, to the vicinity of Hamilton, Ohio. The postponement was requested by the company.

The proposed line, including five compressor stations having a aggregate of 25,600 hp., and a dehydration plant, is estimated to cost $23.5 million. The project would have an initial daily capacity of 140 MMcf of gas, intended to be sold to distributing companies.

• The Federal Power Commission has granted authority to **Iroquois Gas Corp.**, Buffalo, N. Y., and **United Natural Gas Co.**, Oil City, Pa., to construct and operate approximately 20 miles of 16-in. loop line extending from Little Valley, N. Y., to McKean County, Pa. The cost of the construction is estimated at $530,000, of which $465,000 will be borne by Iroquois and $65,000 by United.

Cities Service Properties Segregation Under Way

Cities Service Co. has until May 5 to satisfy the Securities and Exchange Commission order issued in October, 1944, that it divest itself of all utility assets and retain only its oil, wholesale natural gas and miscellaneous nonutility business. The SEC order to dispose of the retail natural gas properties has been contested in the courts by Arkansas Natural Gas Corp., a subsidiary. The federal district court upheld the Commission order and the Fifth Circuit Court of Appeals, New Orleans, confirmed the district court. Arkansas Natural is requesting the circuit court to review its decision and, failing in this appeal, will carry the case to the U. S. Supreme Court.

Accidents Decrease in 1945

The American Petroleum Institute has reported that although the severity of accidents in the industry declined in 1945, the frequency rate showed a slight increase. Deaths and total disabilities among 368,133 workers for 1945 totaled 126, compared with 136 in 1944 for 346,140 employees.

The Gas Burner "FAN-AIR"

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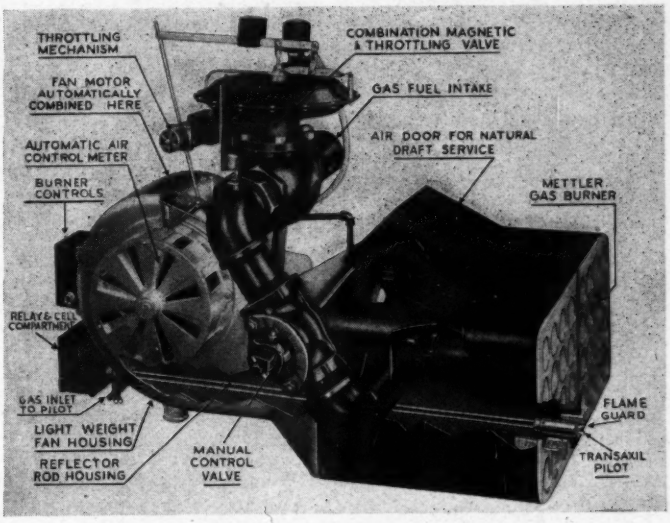

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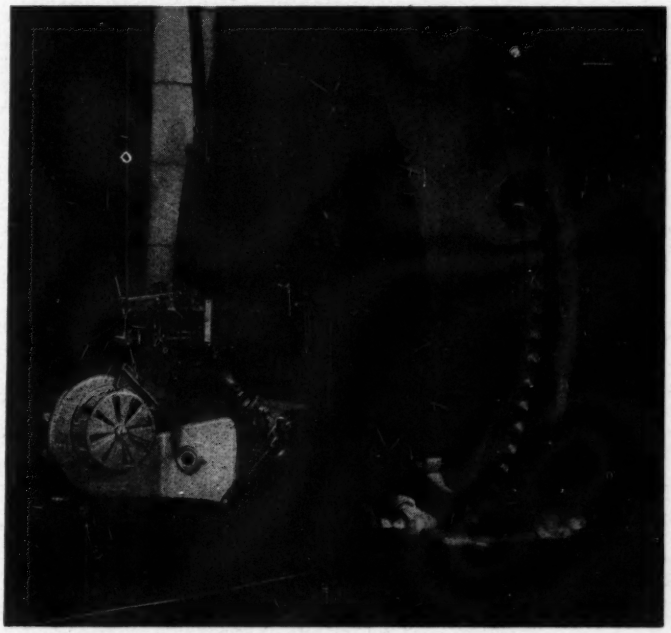

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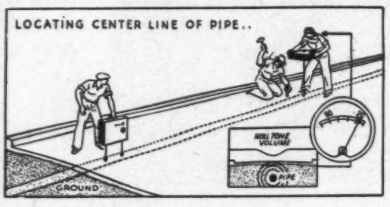

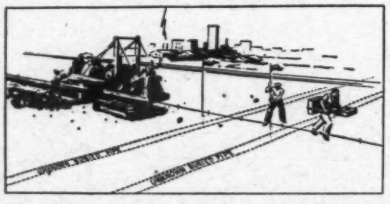

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GAS PRODUCTION

• Recent natural gas pool and gas well discoveries in Oklahoma include the Otha H. Grimes No. 1 Meadors south of Wetumka in Hughes County, at a depth of 3405 ft. with an estimated 30 MMcf of wet gas per day; Deep Fork Drilling Co., and Mulberry Drilling Co., in Lincoln county, at 2413 ft., 2.5 MMcf daily, H. W. Snowden et. al., on the Cement townsite of Caddo County at 5830 ft., production not stated; Ohio Oil and Ramsey No., 1, Caddo County, 4 MMcf daily at 6134 ft.; Service Pipe Line McMillan No. 2, Creek County, drilled to 2059 ft. 2 MMcf daily; Ohio Oil No. 9, Burns in Garvin County, 2.5 MMcf daily at 3037 ft.: Robert Brown No. 1 Jackson, Huges County, 3 MMcf daily at 2563 ft.; Mid-States Oil No. 3. Kiowa County, 730 ft., 50 Mcf daily.

• A seasonal drop in demand for natural gas was shown by allowables set by the Oklahoma Corporation Commission for April and May in the Guymon-Hugoton area and the Charlson deep zones of the Chickasha field in Grady County.

Five purchasers in the Guymon-Hugoton area nominated a total of 7556 MMcf for the month, or 251,867 Mcf daily for April and 251,677 Mcf daily for May.

Total demand in the Chickasha-Charlson zone by four purchasers there was 37.5 MMcf daily for April and 25,484 Mcf daily for May.

• C. R. Ross, of Mt. Vernon, Ill., has opened a new gas area north of Wewoka, Seminole Co., Okla. At 3214 ft. he discovered a daily production of 11 MMcf, with 1150 lb. pressure. The Oklahoma Natural Gas Co. made connections to the well. There are about 400 acres of leases in the location.

Gas production of 10 MMcf per day was proven by the Atlantic Refining Co., near the townsite of Rocky, in Washita County. The gas was discovered at 6170 ft. with flowing pressure of 1600 lb.

• The **Kansas Corporation Commission** has announced removal of production rate restrictions on gas and oil in the Zenith pool of Reno and Stafford Counties.

The Commission announced a gas/oil ratio of 4 Mcf to the barrel and required that gas produced "be delivered to a pipe line or used for some legitimate lease purpose."

• During the latter part of March and in April, the Oklahoma state school land commission conducted sales of oil and gas leases on 23,000 acres of state-owned land.

More than 21,000 acres of the land were in the three Oklahoma panhandle counties—Cimarron, Beaver and Texas, where 133 tracts are located. The Oklahoma sector of the Hugoton natural gas field is in Texas County.

• In Kansas the Bridgeport Oil Co. discovered a 5 MMcf per day gas well in Pratt County at 4446 ft. The Continental Oil Co., had a gas discovery of 2.2 MMcf daily at 4720 ft., in Barber County. In the same county Drillers Gas Co., had a 5.62 MMcf per day well at 4447 ft.

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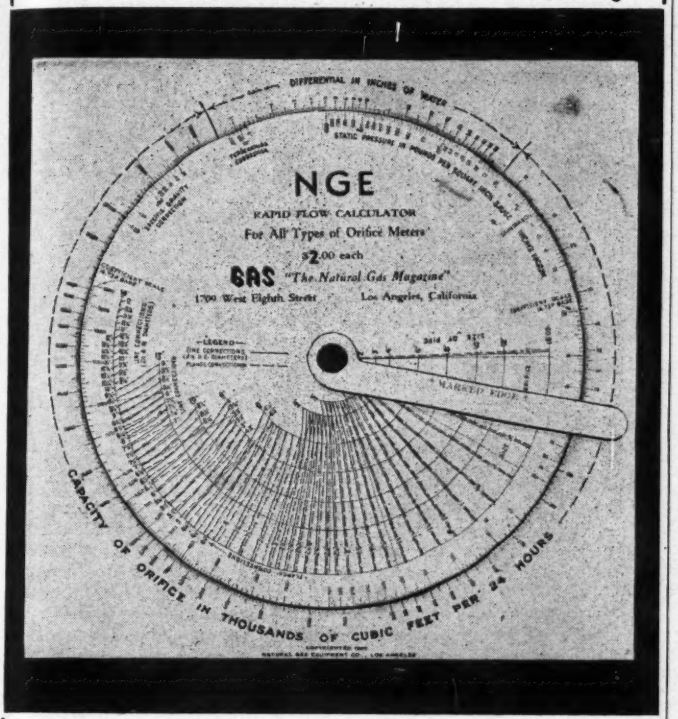
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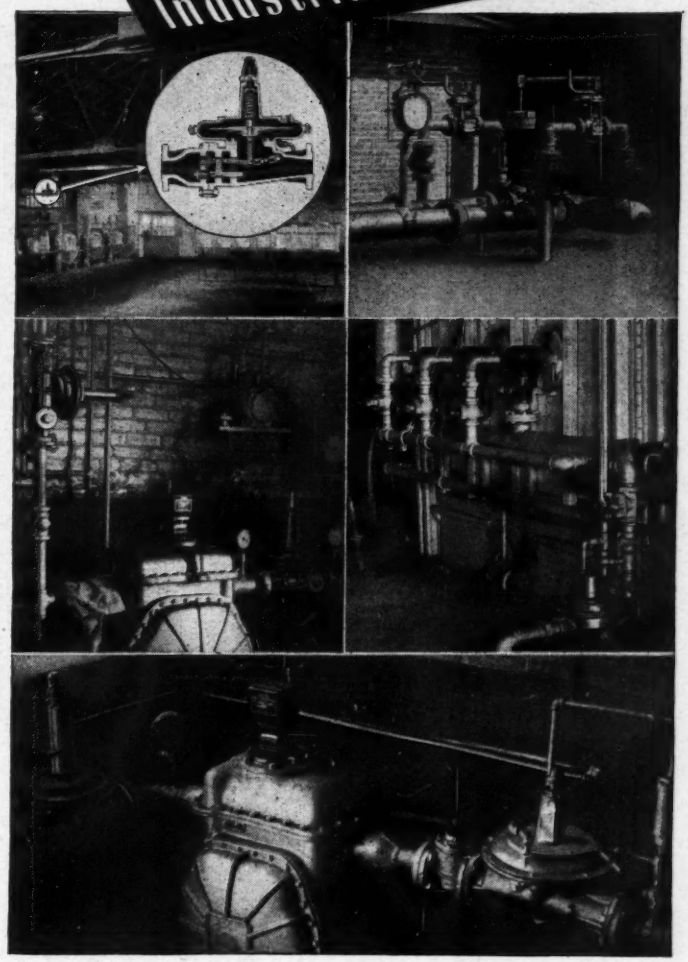

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Texas Officials Oppose Exportation to Mexico

During a recent hearing before the FPC in which Texas officials were seeking to block authorization for increased exports of natural gas from Texas to Mexico by Reynosa Pipeline Co., Cecil Robinson, a geologist, stated that gas reserves south of the Rio Grande are four times those in Hidalgo County, Texas.

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CURRENT READING

Diethylene Glycol Plant Dehydrates Gas to Exact Specification—"Petroleum Refiner," Feb., 1946, pp. 115, 116. In order to meet moisture specifications in natural gas for the city of Long Beach, Wilmington Gasoline Co., Terminal Island, Calif., is operating a dehydrating unit as part of its gasoline plant operations. Gas for city use must have delicate specification of so little moisture that no free water will condense in the distribution system, yet sufficient moisture to prevent internal dry rot. The diethylene glycol unit, built by the city, is so operated by the Wilmington plant staff that about 70% of the moisture content of the residue gas from the absorbers is held within close dewpoint limits. The unit consists of contactor, heat exchangers, glycol reconditioning still, scrubbers, separator pumps and instruments for keeping most of the operations in automatic status. It processes 15 MMcf of gas daily. The plant is described and illustrated.

Classification of Petroleum Reservoirs—O. Wilhelm. "Oil and Gas Journal," Feb. 23, 1946, pp. 171, etc. The system of classification of petroleum reservoirs presented in this article was devised by Dr. O. Wilhelm of the production department of Shell Oil Co., Inc. It is an entirely new approach to the problem of classification and is derived by combining in various ways the sets of geological factors, or trap-forming factors, which cause the trapping of petroleum. Since the number of these trap-forming factors is small, the system is easily built up and may be used to classify any known type of reservoir.

How To Make A Morale Survey—Eugene J. Benge. This manual makes "opinion-taking" simple to obtain and interpret. It gives management the apparatus with which to learn employee attitudes, bring production costs down, and set up a solid foundation for improved personnel policies and training. Loose-leaf, fabrikoid cover. 102 pp., 22 charts. $7.50. National Foremen's Institute, Inc., Box B, Deep River, Conn.

Pipe-Line Technicians Overcome Unusual Obstacles in Building Panama Trans-Isthmian Artery—P. Reed. "Oil and Gas Journal," Jan. 5, 1946, pp. 52-54, 69. This article is the story of the building of the four lines across Panama, a Naval project. The system has a rated capacity of 332,000 to 368,000 bbl. daily, making it one of the world's largest.

How To Get Publicity—Milton Wright. Published by McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 18, N.Y. 226 pp. $2. A simple practical manual telling the businessman how to secure effective publicity for his particular enterprise.

Rangely Field, Colorado—Largest Addition to Reserves in 1945—F. N. Bosco and J. D. Brawner. "Oil Weekly," Feb. 25, 1946, pp. 18, etc. A history of the field, reserves, character of the production, and geologic maps of the area are given.

Helium Gas Grows Up—P. V. Mullins. "Oil Weekly," Jan. 7, 1946, pp. 17-21. The future of helium seems likely to be linked with that of light metals. Highlighted by its use in the Navy blimps during the war, this inert gas has been made spectacular by its effectiveness. It is no longer a laboratory curiosity, and the Bureau of Mines can supply large volumes to anyone who has a legitimate use for it. Undoubtedly helium will be utilized more and more as industry becomes familiar with its properties and availability. It has been found that many of the problems encountered in extracting this by-product of natural gas are common to other phases of the petroleum industry. These are discussed in this paper.

Graph for Determining Velocity of Gas Flow—L. L. Foley. "Oil Weekly," Feb. 18, 1946, pp. 24. The velocity of gas in flow strings is a vital factor in the design of flow strings, particularly in gas lift problems. This problem was discussed by R. R. Hawkins in his paper, "Flowing Wells with Small Tubing," AIME Petroleum Development and Technology, 1932, pp. 306. Hawkins shows a series of charts, each designed for a certain size of tubing. The chart illustrated in this article shows a method of combining them in order that many, or all pipe sizes may be shown on the same chart.

How to Inject Gas into Limestone-Dolomite Reservoirs—J. A. Barnett and M. H. Soyster. "Oil and Gas Journal," Feb. 23, 1946, pp. 161, etc. How gas injection operations should be conducted in limestone-dolomite formations is a prime problem in current petroleum engineering technology, due to variations in pays and the multi-zone conditions usually present. The essential features of a report, "Engineering Report on Grayburg Cooperative and Unit Area," prepared to assist the Grayburg Unit Association in determining the proper locations of gas-injection wells and the best methods for future operation are given in this article.

Plastic Resins as Protective Coatings—P. O. Blackmore. "Product Engineering," Jan., 1946, pp. 1-7. Applications, limitations and future possibilities of protective coatings formulated with liquid plastics. Alkyls, phenolics, ureas, melamines vinyls, vinylidine chlorides, polystyrenes, and silicones are discussed from the standpoint of their utility in commercial finish formulations.

Solid Absorbent Type Dehydration Plant Placed in Operation in Carthage Field—F. H. Love. "Petroleum Engineer," Feb., 1946, pp. 151, 152, 156. The United Gas Pipe Line Co. unit is designed for 1 million std. cu. ft. a day capacity with dewpoint of the outlet gas at 30° F. The plant is described and illustrated.

Proved Petroleum Reserves of U. S. at New High—"Oil Weekly," Feb. 11, 1946, pp. 112-114. United States reserves estimated to have gained half billion barrels despite record production.

Southern Counties Gas Co. May Reduce Gas Rates

Southern Counties Gas Co. may be required to reduce gas rates under a new plan for quarterly adjustment of revenues ordered put into effect immediately by the California Railroad Commission. The aim of the plan is to adjust rates to earnings during reconversion. A test will be made each 90 days to determine the net revenues for the preceding 12 months period.

If these revenues differ by more than $50,000 above or below the standard set at $2.35 million, customers' rates will be adjusted accordingly. An additional 6% return is to be allowed on net operative additions to capital. The plan will remain in effect for a year, and present discount rates will remain until earnings tests under the new adjustment plan show changes are required.

The extent of the rate decrease allowable under the plan is limited only by the earnings increases shown. Upward limit of the rate increases is set at the point where the increases would cancel out present discount rates. At that point the adjustment plan would be considered terminated.

Coal Strike Affects Gas Utility Companies

Returns from a survey of 125 gas utility companies producing manufactured and mixed gas, constituting 43% of that portion of the industry, show that 44 companies, serving more than 1.6 million customers, could not continue normal gas service after April 30 unless furnished additional bituminous coal or coke from stocks now limited by the strike of the United Mine Workers of America. The survey was made by the American Gas Association just before the shutdown of the bituminous coal mines on March 31.

In an effort to continue the gas industry's record of unbroken service, the A.G.A. is cooperating with the Solid Fuels Administration for War and the Civilian Production Administration to replenish coal stocks.

Anderson Stove Co., Inc. Purchased by Breeze

John T. Mascuch, president of Breeze Corp., Inc., Newark, N. J., has announced that the firm has purchased the Anderson Stove Co., Inc., and Foundry Service, Inc., both of Anderson, Ind. The Anderson stove will retain its name and design. It will be distributed by a new sales organization headed by Alfred G. Birkenmeier, former president of the Anderson Co., who remains with the stove firm as president.

FPC Approval Sought For Texas to East Shipments

Three Kentucky and West Virginia gas company officials have asked the FPC to approve an application by Tennessee Gas and Transmission Co. to increase movement of Texas natural gas to the East. L. E. Engham, Owensboro, vice president of Kentucky Natural Gas Co., stated that his company now takes up to 6 MMcf daily from Tennessee Gas and Transmission and could buy up to 15 billion cu. ft. if available.

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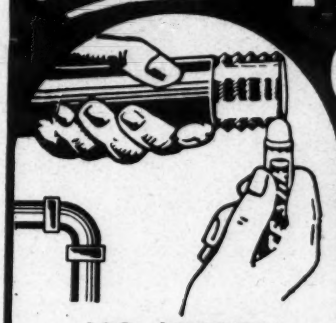

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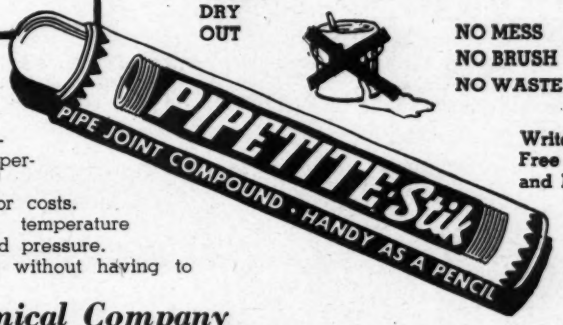

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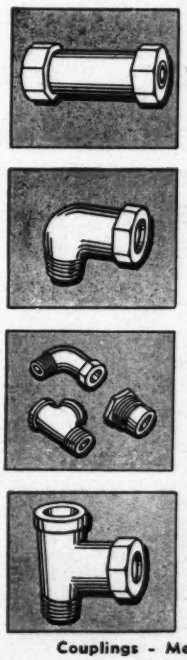

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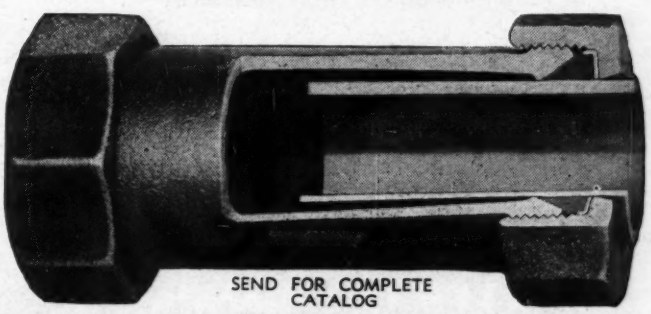

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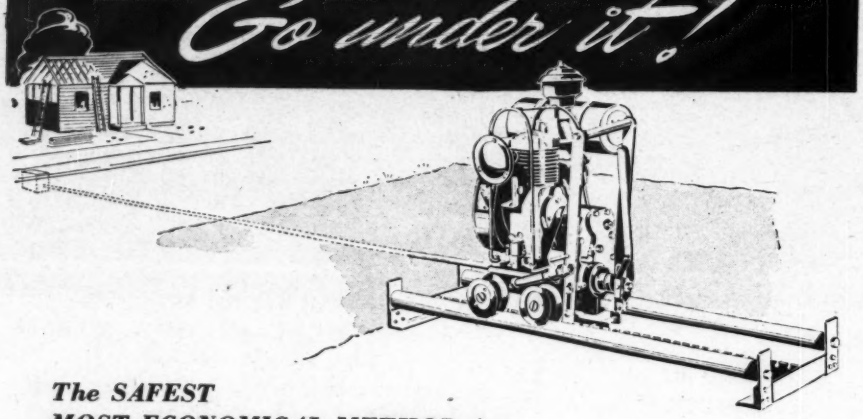

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Montana-Dakota Directed To Reduce Carrier Rates

The FPC has ordered Montana-Dakota Utilities to establish reduced rates for common carrier transportation of natural gas. According to the order, Montana-Dakota is directed to file before June 1, 1946, a new rate schedule for the common carrier transportation of natural gas in interstate commerce reflecting a demand charge of $13.20 per Mcf per year and a commodity charge of 7c per Mcf. These rates will be effective for all gas to be transported in interstate commerce by Montana-Dakota Utilities.

The Mondakota Development Co. had filed with the Commission a complaint against Montana-Dakota Utilities, charging that rates specified in schedules filed with FPC by Montana-Dakota for common carrier transportation of natural gas in interstate commerce were excessive and discriminatory.

Brooklyn Union Announces New Sales Contest

At a recent sales meeting The Brooklyn Union Gas Co. announced the annual insulation contest for salesmen, which is being resumed for the first time since the war. The contest, which will run from April 1 through Nov. 30, offers prizes in six classifications. In the retail division prizes will be given for the greatest number of insulation jobs sold and for the greatest percentage of house heating jobs; to the district sales managers and the district house heating supervisors for the greatest percentage of insulation jobs; and in the commercial and new development divisions prizes will be given to salesmen for the greatest number of insulation sales.

Rheem Institutes New Dealer Credit Plan

Rheem Manufacturing Co. has instituted a national sales finance plan through which dealers, jobbers and distributors may stock a full line of Rheem appliances with a cash outlay of only about 10%. Dealers submit their financial statement to any one of a national network of 2400 cooperating banks, order the merchandise and give the name of the bank. A 10% down payment is made and thereafter payments are made directly through the bank. The plan permits dealers to carry a full line of appliances and frees cash for other transactions.

Texas Gasoline Plant

Construction was nearing completion on the $3 million gasoline plant of the United Gas Co., Carthage, Texas, to supply gas from the Pettit lime gas reserve in Panola County, East Texas. Capacity of the plant will be 50 MMcf daily.

In the field a 20-in. loop line of the gathering system is being laid. The Skelly Oil Co. also is laying 33,500 ft. of 12-in. lateral lines. The Carthage pool has 228 producers, part of which produce gas and distillate from the Travis Peak sand of the Basil Trinity and also from the Rodessa section of the Glen Rose.